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PREFACE.

This year has been less remarkable for great events than for the steady and gratifying progress which has been made in every branch of the two professions, to recording the labours of which our Journal is devoted. The financial embarrassment of the country, and the course of political events, have been far from favourable either to the promotion of existing undertakings, or the formation of new ones. With regard to architecture, it must have been gratifying to our readers to have witnessed the increasing interest which has been shown by the public of late years on this subject, manifested by the demand for competitions, and the extended discussion of architectural topics in the higher class of general periodicals, while a strong feeling seems to prevail as to the necessity of enlightening the public mind, and bringing it to bear upon this as upon other branches of the arts. Architecture has at last been recognized as a subject for collegiate education, by its introduction into King's College, and by the formation of architectural schools in the national dockyards. The Royal Academy has given signs of a more liberal disposition towards the profession, by the election of Barry, notwithstanding his known connexion with the Royal Institute—a step highly important. The Institute of Architects of Ireland has been established, and the royal patronage bestowed upon it. The Revival style, as we announced last year, has now gained a footing in this country, at the same time that considerable progress has been also made in internal decoration by Parris, Latilla, Owen Jones, and other artists of talent; so much better disposition is now shown to unite this branch of the arts with architecture, that there appears every prospect of the Houses of Parliament being painted in fresco, although we hope not, as has been suggested, by foreign hands. The temple of English freedom should never be desecrated by strangers.

We have not this year, as previously, to regret the loss of many great edifices, although York Minster has suffered considerably by fire. Among the ancient buildings in which restorations or improvements have been carried on, may be mentioned Westminster Abbey, the Temple, St. Aldate's, York Minster, Thorney Abbey, St. Mary Nottingham, St. Michael's Basingtoke. Few buildings of any note have been completed, although many are in a satisfactory state of progress; we may, however, mention the Reform Club, the Club Chambers Association, the Princess's Theatre, and the Manchester Unitarian Chapel. Several fine railway stations have been erected, and cemeteries opened in London and different parts of the country. The subject of a change in the system of prison discipline now in agitation, seems to promise, at an early period, extensive employment for the profession, as also the question of national education, and the construction of school-houses consequent thereon. The profession in Ireland has been largely employed in building union workhouses, some of which are on a large scale; a prospect also exists of similar employment for our Scotch brethren. It will be a matter of gratification to consider that the important question of the architectural and sanitory police of large towns is now attracting much attention. Something therefore may be expected to be done.

Among the architects whose loss we have this year to regret, are Sir Jeffry Wyatville, Albertolli, and Mr. Whitwell.

The engineering profession although having greater obstacles to contend with than the architects, have shown rather more vigour, and will require therefore a more lengthened statement of the progress they have made. Engineering education is making still greater advances, a new faculty has been established at Glasgow, and the first Regius Professor of Engineering appointed, the other faculties have been improved; at King's College the architectural instruction has been extended, and a lower school formed for elementary instruction. To the Mining schools we shall hereafter have occasion to advert; we may farther mention the increased qualifications required of enginemen by the Admiralty, the examination of officers on the steam engine, and the delivery of lectures at the Royal Naval College, the establishment of a College for Civil Engineers at Putney, and the project of a School of Practical Engineering at the Polytechnic Institution. While at this point we may mention that honorary degrees have been conferred by the universities, upon several engineers, and also upon Junius Smith, the great promoter of Atlantic Steam Navigation. The University of Edinburgh have ordered from Chantrey, a statue of Watt, being the sixth of that great man, and the Institute of Civil Engineers have this year offered premiums for memoirs of eminent engineers; we regret however, to remark, that no disposition has been shown by the Government to bestow the same honours upon this as upon other professions. Prizes have been awarded by an Association at Glasgow, for improvements in safety valves. The local exhibitions of arts and manufactures have acquired this year still greater extension, and probably we shall not long wait for a national exhibition in the metropolis.

The railway system has in several ways prominently attracted public attention. We shall first advert to the number of lines which have been this year either wholly or partially opened. Among these are, the Great Western, Brighton, Blackwall, Eastern Counties, Northern and Eastern, North Midland, York and North Midland, Manchester and Leeds, Hull and Selby, Glasgow and Ayr, Glasgow and Paisley, Maryport and Carlisle, Preston and Wyre, Lancaster and Preston, Chester and Birkenhead, Chester and Crewe, Manchester and Birmingham, Birmingham and Gloucester, and Taff Vale. On nearly all the great lines most fearful and unprecedented accidents have within the last few months taken place without any satisfactory cause for their extent, they seem indeed to be the result of a similar mysterious visitation to that by which steam navigation was afflicted last year and the year before, and from which it has been this year free. Government have been as usual meddling this year, and we regret to say with greater success than before; besides employing parliamentary committees and itinerant commissioners who have been employed on the Scotch and Holyhead routes, an act has been past for giving the Government an unprecedented control over the lines. Only one bill for a new railway passed last session. The system of leasing small lines to other companies, and of the union of lines has been much extended. Rope traction has now been shown on a considerable scale on the Blackwall railway, on which wire rope is proposed to be used, and a large experiment has been made of the pneumatic system on the West London Railway. Electric telegraphs have received some improvements, and their utility for railway purposes may now be considered as finally recognized. The French government have this year shown a better spirit as to the railways, but they make but small way, the Paris and Rouen projectors have however raised large sums in this country. The Russian government have sent an engineer to this country to prepare for the formation of railways in Russia on a large scale, and it may be observed that generally the European nations are making progress as to the introduction of the system.

The use of wood pavement for the streets has greatly extended both in London and the provinces, and the use of asphalte also seems to be established. Measures are in progress for running locomotives on common roads.

The appointment of commissioners for inquiring into the state of our coasts, has been a measure long called for by the mercantile interests of this country; but whether the recent labours of the harbour commissioners will either prove satisfactory or useful, yet remains to be seen. During the year improvements have been made at Leith, Fleetwood-on-Wyre, the Bute Docks at Cardiff, Ramsgate, Rye, and Woolwich. In this latter establishment we may also call attention to the introduction of the steam machine for making shot. At Granton a pier has been erected; in the Downs a safety beacon on a new principle; and this year we have seen the first application of the screw pile system to the erection of a lighthouse at Fleetwood-on-Wyre. Considerable attention has been devoted to the embankment of the Thames, into which subject Parliament has inquired; the river works of the new Houses of Parliament have been completed, and hopes are entertained that either by the city or goverment, works will be carried on so as to improve the whole north bank of the river; an extensive embankment on the shores of the Thames and Medway has been made by Lord de Vesci. The propositions for draining the Lake of Haarlem, and for recovering land in Morecambe Bay and the Wash, have caused many engineers to direct their inquiry to improvements in draining, as far as regards the application of mechanical power to such purposes. The Chard and the Ulster Canals have both been opened, and some extensive works completed on the Hereford and Gloucester. The repairs of Blackfriars Bridge have been satisfactorily ended, while great progress has been made with those carried on at Westminster Bridge; some majestic viaducts have been constructed on the railways. The application of Rendel's system of floating bridges has been extended to Portsmouth and Calcutta.

The interests of steam navigation having been seriously threatened by the proposed application of stringent government measures, we considered it our duty to awaken the attention of the marine engineers to the subject, and we congratulate our readers on the success which attended our efforts, such a union of the profession having been organized, and such effective measures taken, as to compel the authorities to postpone the intended bill. The importance of steam ships as a part of our marine, has been shown by recent hostile events, when the agency of this arm, both in Syria and China, has been so exerted. The government have shown their sense of it by giving higher rank and privileges to the enginemen in the naval service, by directing schools for their instruction to be formed in the dockyards, and by making an acquaintance with the marine engine a part of the studies of the superior officers. The French government have greatly enlarged their engine factory. The investigation of the properties of the Archimedean screw has been continued, and its utility recognized, at the same time that the question of modes of propulsion has been the subject of extensive experiment. The application of propellers to sailing vessels, as in the Earl Hardwicke and the Vernon, has been successful. The introduction of steam navigation on canals, has also tended to direct attention towards propellers, and to the use of iron as a material for steam canal boats and for passage boats, of which the Lee, the Nonsuch, and the Alice are examples. Iron has been so extensively used as a material of construction for steam boats, as already to have given a great deal of employment to marine engineers. Abroad, iron steam boats have been introduced on the Danube and the Elbe. Iron has been applied considerably for constructing sailing vessels; it has also been used for a floating fire engine. The experiments continue on the application of electro-magnetic power to navigation, but with no tangible result. Steam navigation has, this year, been greatly extended; Fleetwood-on-Wyre has been added to the steam ports; the Mediterranean service has been more efficiently organized; in the Atlantic the number of steamers to the United States has been increased, and a line to Boston established, communication with Madeira has been opened; in the Pacific, steamers are now running along the western coasts; in India, increased means of communication with England still occupy the public mind; attention has also been directed to the capabilities of the Indus and its tributary streams.

Mining is greatly advancing as one of the branches of the profession, or a branch likely to be promoted by the measures taken for giving instruction in it. The munificence of Sir Charles Lemon has established in Cornwall a special school for mining, and professorships also exist in King's College, London, and at Durham. Instruction in mineral chemistry, so much required, has been promoted by the establishment of the government school attached to the museum of economic geology, and by the courses delivered in several public institutions. The powers of Cornish engines have been the subject of serious discussion among our engineers, and the attention of the Dutch government has been directed to them to ascertain their applicability for economical draining.

Among the engineers who have been this year lost, we have to mention with regret, Sir Robert Seppings, Lieut. Thomas Drummond, and Mr. Hazeldine, an engineer employed on the Menai and Conway bridges.

Having thus disposed of the interests of our readers, it remains that we should ask their indulgence while we recall to them the exertions we have ourselves made in fulfilling our duties towards them. For this we appeal with confidence to the volume just concluded, where they will find that our correspondence has increased in value and interest, and that no exertion or expense has been spared to render the work worthy of the increased patronage it receives. Our readers will find in it 432 pages, 21 plates and 214 engravings, forming a mass of information which, for value and for cheapness, is not surpassed by the periodical works of any profession. Such have been our endeavours in our communication with the professions through the medium of these pages, but we have not hesitated, neither shall we, to exert ourselves for them, when and where we may have it in our power, by acting in a public capacity. Such we considered to be our duty on the steam navigation question, as we shall on every occasion where the interests of the professions require it, and our humble efforts can in any capacity be exerted in their defence.

INDEX.

Air, passage of, through pipes, 300.
Antiquities:—Egyptian, 12; St. Mary Aldermary, 25; Perranzabuloe, 90; Bilingual inscription, 132; tombs at Cære, 209; tumulus at Bougon, 231.
Aqueduct at Dijon, 398.
Arabesque decorations, 94.
Arch, expansion of, 133.
—— origin of, 354.
—— pointed, 318.
—— skew, 109, 116, 152, 179, 197, 230, 231, 232, 274.
Architects, *vide* biography:—Bartholomew, A., 259, 301, 330, 365; Blore, E., 255, 257; Brown, 54; Cottingham, C., 249; Donaldson, T. L., 2, 147, 209; East, F., 322, 354; Francis, F., J. 337; Fripp, S. C., jun., 105; Godwin, G., jun., 210, 217, 249, 258; Harris, W., 179; Jones, Inigo, 3; Poynter, A., 94; Pugin, A. W., 197, 215, 225, 228, 257, 272; Tattershall, R., 2; Thomson, J., 261, 321; Tite, W., 223, 258; Walker, T. E., 25, 39; Watson, J. B., 215; Wightwick, G., 254, 272, 301, 352.
———— table of, 112, 140, 147, 183.
Architects, Royal Institute of, 69, 93, 136, 209, 211, 248, 261, 285.
Architects of Ireland, Institute of, 132.
Architectural Society, 35, 248, 427.
Architecture, *vide* Buildings, Ecclesiastical, Architects, Engineering, Stone, Iron, Timber, Arch, Competition, Ralph, Candidus, Rambles by Philomusæus, Medieval Architecture, Gardening.
———— Abbotsford, 3; Architectura Domestica, 34.
———— arch, origin of, 354.
———— at home and abroad, 90.
———— beauty of outline in, 329; Blenheim, 262; British Assurance Office, 225; Buckingham palace, 156; buttresses, 365.
———— Byzantine style, 219.
———— Cambridge libraries, 32; Capitol, Washington, 293; capitals, 373; churches, 75; church pews, 225.
———— chronology of styles, 143; columns, 143, 156, 373; cornices, 250, 329; distinctive causes of Greek and Roman, 337; East India House, 293; Edinburgh, 156; German architects, 91;
————Government school, 327.
———— horizontal and vertical line, 137, 186, 210, 228; house decoration, 363; Italian, 156; landscapes abroad, 4; landscape gardening, 52.
———— history of English, 2.
———— Liverpool, 356, 410; Mansion House, 294, 399.
———— Medieval in France, 143, 219; Munich, 91; National Gallery, 3.
———— origin of vertical line, 137.
———— original composition, 261.
Architecture, painted glass, 217, 249, 255, 258, 276, 373; Pantheon, 293; Parisian houses, 310; pinnacles, 365; pointed arches, 318.
———— porticoes, 293, 356, 389.
———— profession in France, 7; public walks, 85.
———— Reform Club, 75, 141, 329; revival style, 257.
———— Romanesque style, 143; Royal Academy, 187.
———— Russian, 93.
———— St. Genevieve, 293; St. Martin's, 263, 294; St. Paul's, 227, 329; St. Paul's, Covent Garden, 293, 373.
———— shops, London, 43.
———— simplicity of plan, 3.
———— slate, 73.
———— Soane museum, 155, 301.
———— table of buildings erected in Paris in the 19th century, 203.
———— table of porticoes, 389.
———— Vanbrugh, 262, 321.
———— Vatican, 94.
———— Whitehall, 3, 264; windows, 3.
———— wire fences, 49.
———— York column, 156.
———— naval, *vide* Ship-building, Steam-boat, Boat.
Armstrong, R., on Cornish engines, 4; on steam

engine technical terms, 89; on indicating power, 126.
Artesian wells, 20, 51, 99, 118, 249, 264; absorbent, 118.
Asphalte, artificial, 215, history of, 427.
Bald, W., on the Broomielaw Wier, 415.
Barrett, H., on moving beach, 195.
Beach, moving, 195, 237, 239, 258.
Beam, trussed, Laves's, 161.
Beaufort, Duke of, mansion, 226.
Biography—Albertolli, 147; Alison, Rev. A., 24; Archer, T., 249; Beazley, C., 147; Broderip, C., 142; Davy, Rev. M., 23; Drummond, T., 164; Dudley, 390; Telford, 30; Gilbert Davies, 66, 99; Johnston, F., 183; Lushington, E. L., 24; Muss, 217; Perry, Capt., 108; Peterborough, Bp. 23; Pitts, T., 164; Prevost, P., 24; Prony, De, 24; Repton, 52; Rigaud, 23; Saunders, 24; Seppings, Sir R., 211; Telford, 30; Whiterell, 211; Wyatville, Sir J., 130, 286.
Blasting, *vide* gunpowder, Royal George, 215; under water, Dresser's plan, 341; limestone rock, by Bald, 165.
Blowing up Cannon-mills Bridge, 291.
Boat, iron canal, 175.
Boring, 198, *vide* Wells.
Botanic Gardens, Regent's Park, 173.
Brick machine, Bakewell's, 160; Bedborough's, 175; White's, 184.
Bricks, 144, 155, 160, 175, 180, 255, road, duty free, 255.
Bridges, *vide* hydraulic, arch Ardrossan, 29; Belleek, 344; Blackfriars, 286, 327; blowing up, 291; Broomielaw, 415; Calcutta, 398; Chinese, 268; Enniskilleen, 344; floating, Portsmouth, 215, 398; Gloster, 31; Hann's, 31; iron, 161; Menai, 193, 268; Portsmouth, 137; rope, 268.
Suspension, Dredge's, 193, 286; Haslar, 384; theory of, 268; fall of, 345.
Teignmouth, 38; timber, 358, 422; trellis, 152; trussed, Laves's, 161; Victoria, Bristol, 193; Westminster, 177; wire, 268; wood, 125, 161, 175.
British Association, 357, 386, 420.
Bude light, 18.
Building—Arch, 109, 116, 133, 152, 179, 197, 230, 231, 232, 274, 318, 354; beam, 161; cement, 266; concrete, 120; covering roofs with planking, 424; mica, instead of glass, 346; papier mâché, 201; porcelain letters, 176; puzzolana, 266.
Buildings, *vide* Ecclesiastical, Architecture, Theatre, Ashton Court, 52; Assize Courts, Liverpool, 158, 190; Bank, London and Wesminster, 84; ditto, Rochdale, 255; ditto, Savings, Finsbury, 217; ditto, Union, 183; Bielefeld's works, 8, 160; Blenheim, 262, 286; Capitol, Raleigh, 394; Chatsworth Picture Gallery, 286; Claverton Inn, 130; Cobham Hall, 53; Collegiate Institution, Liverpool, 255; Courts of Law, 210; Elizabethan shop fronts, 257; Fitzwilliam Museum, 88; Hospital, Bedworth, 39; Jail, Peterboro, 27; Mansion House, 294, 399; Market, Llandovery, 39; ditto, Bodmin, 179; Merchant Seaman's Institution, 251; Pantheon, 195; Pavilion, Brighton, 53; Polytechnic Institution, 321; Reform Club, 75, 141, 329, 409; Redbourne Hall, 257; Royal Exchange, 67, 132, 199, 210, 224, 399; Southwark Institution, 363; Theatre, Adelphi, 394; ditto, Princess, 394; Townhall, Ashton-under-Lyne, 255; ditto, Helston, 179; Victoria Rooms, Bristol, 411; Warwick House, Birmingham, 128; Woolwich Workhouse, 68.
Calculating balance for engineers, 21.
Canal boats, iron, 175, 314; Chard, 327; Erie, 124; *friction dynamometer*, 384; Gloster and Hereford, 178, 398; lockage, 384; lock valves, 396; [illegible]ford and Worcester, 215; steam navigation, 398; traffic, 311, *376*; *Ulster, 344*; Wyerley, 177.
Candidus's Note Book, 3, 75, 118, 155, 224, 271, 301, 333, 373, 402.
Cannon *boring, 172.*
Carriages—Adams vertebrated, 56; break, 26, 175; *Curtis's truck*, 5; *draught of carriages*, 20; *effect* of curves on, 267; friction [illegible] 291; resistance of, 169; screw jack, 386.
Cement, 266.
Chain cable, recovery of, 395.
Chapels, *vide* Ecclesiastical Buildings.
Chatterton monument, 105.
Churches, *vide* Ecclesiastical Buildings.
——— on rebuilding old, 190; Catholic, 197.
Clerke, Hyde, on absorbent Artesian wells, 118.
Coal, combustion of, 412; India, 216; properties of, 423.
Coalfield, Forest of Dean, 347.
Cofferdam, Neville, on pressure of water on, 78; new houses of parliament, 283.
College for Civil Engineers, 57; King's, 68, 426.
Column, Nelson, 178, 211, 327, 355, 379, 413.
——— General Clayton's, 181.
Colours, Nobili's, plate of, 207.
Compass pivots, 422.
Competition Designs, *vide* Exhibitions, 7, 61, 130, 132, 158, 173, 224, 331, 371, 378, 406; Bury St. Edmund's, 331, 371, 406; Cardiff, 61; Ireland, 378; Oxford, 378; drawings, exhibition of, 194.
Concrete, patent, 120.
Cotton gins, experiments on, 313.
Curtis's railway truck, 5.
Cycloidal paddle-wheel, 35.
Dagenham breach, stopping of, 106.
Dock—Bute, 167; Chatham, 120; Liverpool, 362; Woolwich, 27, 37, 120, 362, 363.
Draining, *vide* Water, Hydraulic, Fleet sewer, 398; Haarlem lake, 327; Fiskerton, 362; Fairbairn on, 412.
Dry rot, 26, 27, 418.
Dyer, C., Victoria Rooms, Bristol, 411.
Earthwork in cuttings and embankments, method of computing, 334, 413.
East, F., on the origin of alphabetic writing, 403; on the horizontal line in architecture, 186, 228.
Ecclesiastical Buildings, *vide* Architecture, Ashted church, 399; Arles, St. Trophime, 144; Ash church, 215; Attleborough church, 39; Athens cathedral, 220; Atherstone convent, 393; Avignon cathedral, 143, 144; Basingstoke church, 339; Bedford, St. Paul's church, 288; Bethnal Green church, 362; Birmingham church, 179; Blackheath church, 71; Boston Wesleyan chapel, 399; Bow church, 200, 329; Caen, St. Peter's 329; Calcutta cathedral, 71; Camborne church, 171; Catholic churches, 228; City cemetery, 363; church pews, 225; convent, Birmingham, 215; Darlington church, 32; Dukinfield Unitarian chapel, 2; Falmouth church, 255; Flushing church, 255; Freiburg cathedral, 329; Golden Hill church, 327; Great Haywood church, 399; Guilsborough church, 254; Handsworth church, 215; Hill Top church, 327; Horsham church, 255; Keswick church, 32; King's College chapel, 329; Lanner church, 255; Lower Beeding church, 255; Lee church, 288; Liverpool, St. Barnabas, 71; Messing church, 215; Mile End church, 39; Menetes Keras, 221; Mosque, Armedabad, 329; New Catton church, 288; Nottingham, St. Mary's, 215; organ, 357; painted windows, 217, 249, 255, 258, 276, 373, 399; Panagia Lycomido, 220; Plymouth, Trinity, 254; Poitiers, St. John's, 144; ditto, Nôtre Dame, 221; Portreath church, 255; Ravenna, St. Vital, 219; Ramsgate church, 363; Rome, St. Paul's, 179; Ryde church, 409; Russian churches, 93; St. Bride's, 329; St. Dunstan's in the East, 330; St. Paul's, 227, 329, 330; Salisbury cathedral, 329; Sancta Sophia, *220, 221*; Salt church, 179; Sergius and Bacchus church, 220; Stone church, 318; *Temple church*, 255; Thorney abbey, 255; Tours, St. Martin's, 143; Westminster abbey, *249, 276*, 302; Wolverhampton church, 39, 71, 399; York Minster, 211, *276.*
Electro-chemistry and metallurgy, 324.
Embankment, *vide* Hydraulic. Morecombe Bay, 71; near the Medway, 258; Thames, *258, 359, 383*; Lough Foyle, 346.
Engineering, *vide* Arch, beam, *blasting*, brick, *bridge, canal, college, concrete, dock, gas, geology,* harbour, *hydraulic, lime, lighthouse, machine* manufacture, mining, pavement, pier, pump, railway, river, *road*, steam, surveying, wall, water, Alexandria, 39; American, 123; arches, skew, 109, 116, 152, 179, 197, 230, 231, 232, 274; earthwork, method of computing, 334, 413; photography, 385; profession in France, 7; teachers of, One who has suffered, &c., 148, 189.
Engineers, *vide* Biography. Armstrong, R., 89, 127; Bald. W., 165, 197, 309; Barlow, W. H., 275; Buck, G. W., 197, 231, 274, 308; Cockerill, J., 39; Curtis, W. J., 5, 76, 129; Hodgkinson, E., 248; Hughes, S., 334; Mitchell, A., 322; Neville, J., 78; Nicholson, P., 230, 274; Parkes, J., 282; Rennie, G., 25, 133; Rennie, J., 237; Seaward, J., 374; Smith, Junius, 400; Wicksteed, 10, 282, 367.
Engraving, galvanic, 148, 164; daguerreotype, 280.
Exchanges, history of, 223.
Exhibition, designs for Royal Botanic Garden, 173; Royal Academy, 187, 222, 257.
Fairbairn, W., on draining, 412.
Fine Arts—Rouen, 39; Arabesque, 94; British Museum, 12, 84, 394, 404, 417; Chatterton monument, 105; Fresco, 226, 278; Soane Museum, 155, 301; Gallery of Arts, 132; glass painting, 217, 242, 255, 258, 276, 373, 399; Hampton Court, 164; School of Design, 164, 250; Huskisson statue, 86; July column, 250; painted window, 431; Napoleon monument, 327; Redbourne Hall, 278; Rouen, 39; Oxford memorial, 286, 393; stone and bronze, comparison, 355; statues, 394.
Fleetwood-on-Wyre, 400.
Fresco painting, 226, 278.
French historical commission, 171.
Fuel, 134, 176; Edward's, 363; combustion of, 412.
Gardening, public walks, 85; landscape, 52; wire fences, 49; botanics, 173.
Gas, *vide* Bude light. Antiquity of, 263; account of, 137; bituminous schist, 308; regulator, 386; Seguin's, 29; Val Marino's, 26.
Geological Society, 68, 99.
Geology, *vide* Harbours, Mining, Stone, Lime.
——— Bendable stone, 183; Bourne river, 103; Cornwall, 39; coal, India, 216; ditto, Forest of Dean, 347; earthquake, 71; economic, museum of, 380; encroachments of sea, 39, 64, 167, 189; fossils, Horsham, 255; landslip, 71, 216; London clay, 249; moving beach, 195, 237, 239, 258; petroleum oil well, 363; Sheppy, Isle of, 25, 189; solubility of silica, 282; Venice, 71; Vistula, 210.
Gilding metals by electricity, 277.
Glass, flint, manufacture, 316.
——— Mica as a substitute, 346.
——— Painting, history of, 217, 258, 276, 373.
Great Western Steam-ship Company, meeting, 158.
Groundrope apparatus, 87.
Gunpowder balistic clock, for proving, 21.
Harbour, *vide* Lighthouse, Geology, Dock, Beach, Hydraulic, Tides.
——— Aberdeen, 29; Ardglass, 146; Algiers, 265; beach, moving, 195, 237, 239, 258; Beachy Head, 240; Brighton, 286; Broadstairs, 237; Crane, 28; Cuxmere, 239; safety beacon, 345; Dantzick, 229; Deal, 195, 237, 259, 345; Dover, 21, 146, 167, 195, 238, 240, 259, 321; Dublin Bay, 146; Fleetwood, 132, 181; Folkestone, 21; Hastings, 238, 259; Kingtown, 146; Leith, 71; Littlehampton, 240, 259; Lowestoft, 145; Margate, 237, 240, 259; Newhaven, 239, 259; Pagham, 240; Penzance, Palmer's Report, 21; Portrush, 146; Ramsgate, 21, 195, 237, 259; refuge, Mr. Barrett, 145; report on South Eastern, 236, 259, 321; Rye, 238, 259; Sandwich, 237, 253; Shoreham, 38, 239, 259; Swansea, 21.
Harvey and West's valve, 41.
Hooper's letter weights, 88.
Hydraulic Works, *vide* Harbour, River, Canal, Pi[illegible] Dock, Water, Pump, Drainage.
——— Algiers, 265; aqueduct at *Dijon, 398*; balance gates, 42; coffre dam, Neville on pressure of water, 78; ditto, houses of parliament, 283; Dagenham breach, stoppage of 106; draining, Fleet sewer, *398; ditto, Fiskerton, 362*; ditto, Haarlem lake, 327; ditto, Lough Foyle, 346;

embankment near the Medway, 258; ditto, Morecambe Bay, 71; ditto, Thames, 258, 359, 383; land-springs, 120; Lough Erne, 343; Loughs Foyle and Swilly, 346; mortar, 266; piling, 29; puddling, 30.
Institute of Civil Engineers, 97, 133, 211, 248, 282, 314, 346, 384, 423.
Iron, anthracite, Ystalyfera, 342.
—— coach, 327; corrosion by water, 424.
—— corrosion, Neilson's patent, 363.
—— ditto, Wall's, 429.
—— history of, 390.
—— lower deck beams, 398.
—— malleable, in Persia, 296.
—— manufacture, Guest's improvements in, 396.
—— pillars, experiments on, 248.
—— schooner, 397.
—— steam boats, 37, 69, 104, 177, 211, 212, 252, 288, 292, 325, 348, 362, 388, 397, 398.
—— strength of, for ship building, 388.
—— water and air, action on, 387.
Jackson, G. B. W., on computing earthwork, 413.
King's College, 426.
Lardner, Dr., lectures on railways, 128, 168.
Leeds, table of architects, 112, 140, 147, 183.
Lighthouse, Wyre, screw pile, 132, 181, 229, 251, 322; lights for, 283.
Lime, 176, 266.
Limekiln, Menteath's, 176.
Limestone, 309, 340; blasting, 165; in Ireland, 198.
Lough Erne improvement, 343.
Locomotive Engines, *vide* Steam Engine, Carriage.
———— adhesion of the wheels of 18; alarum, 322; American, 289, 347; common road, 254, 280; Great Western, 168, 178; Hancock's, 280; Hull and Selby, 427; London and Birmingham, 315; manufactory, 32; power, 101, 168; Rudge's, 364; wheels, 357; wheel, wood tyre, 386; ditto, metallic, 401.
Machine, *vide* Steam Engine.
—— Brick, 160, 175, 184; cannon boring, 172; draining, 412; gunpowder, proving, 21; ground-rope, 87; planing, 172, 291; plough, steam, 160; propeller, 25, 49, 157, 292, 397; pump, 26, 273, 363; refrigerator, 211; saws, 26; screw jack, 50, 386; shot, 363; turbine, 420; washing, 28, 90.
Manufacture,—Gilding metals by electricity, 277; glass, 217, 258, 276, 316, 346, 373; iron, 37, 69, 104, 177, 211, 212, 248, 288, 292, 296, 325, 327, 342, 348, 362, 387, 388, 396, 397, 398; lime, 176, 266; papier mâché, maps, 201, 286; paper, 396; patent felt, 367.
Memorial, *vide* Column, Statue.
—— Chatterton, 105; Neale, 288.
Mica, use of, instead of glass, 346.
Mining, *vide* Geological Society, Lime, Coals, Iron, Stone, Gas.
—— asphalte, artificial, 215; blasting limestone, 165; burning coal mines, 179; coal, India, 216; iron, 390; lead, 284; limestone, 165, 176, 198, 266, 309, 340; mines, 99; Persian iron, 297; raising water, 419; Rayas, 352; safety lamp, 36; slate, 73.
Monument, Napoleon, 406.
Monument, *vide* Memorial.
Moorsom, Capt. W., on embankments, 406.
Mornay, A. A., on railway curves, 15; on the theory of the steam engine, 59, 149.
Neale testimonial, 288.
Nelson column, 178, 211, 327, 355, 379.
Paper manufacture, Martin's, 396.
Papier mâché maps, 286; ornaments, 201.
Parliament, proceedings in, 69.
Parris's, Mr., decorations, 278.
Patent, Sharp's, 428.
Patents, *27, 40, 72, 104, 139, 175, 180, 216, 256,* 292, 328, 364, 400, 429, 431.
Pavement, wood, 67, 164, 215.
Pedestal, Hyde Park Corner, 362.
Peppercorne, Mr., 256.
Pier, vide Hydraulic.
—— Aberdeen, 29; Algiers, 265; Granton, 324; *Margate, 37.*
Planing machine, Rennoldson's, 291.
Porcelain letters, 176.
Pott's picture hanging, 400.
Power, improvement in obtaining, Poole's, 314.
Poynter, A., on arabesque, 94.
Pump, *vide* Valve.
—— Gravel, 26.
—— Rotatory, Sutcliffe's, 273.
—— Stuffing box, Horne's, 363.
Puzzolana, 266.
Railway, *vide* Locomotive Carriage.
—— Act for regulating, 381; American, 430; Altona and Lubeck, 308; atmospheric, 164, 253, 259, 379; Belgian, report on, 288; Birmingham and Gloster, 38, 139, 214, 289, 399, 406; Blackwall, 38, 178, 213, 290; bridges of timber, 358, Brighton, 38, 103; Bristol and Exeter, 213; Cheltenham and Great Western, 214, 254; Croydon, 38, 137; curves, 15, 74, 128, 169, 385; curves, effect of, on carriages, 267; dial, 397; Dublin and Drogheda, 398; Dundee and Arbroath, 70; Eastern Counties, 38, 290; economy of, 422, Edinburgh and Glasgow, 70, 179, 289; fares, 278, 311, 376; friction dynamometer, 384; French, 254; Glasgow and Ayr, 38, 215, 290; Gloucester and Newport, 430; gradients, 168; Grand Junction, 38, 168; Great Western, 38, 71, 103, 168, 178, 179, 290; Great North of England, 71, 231, 254; Greenwich, 103, 430; ground rope apparatus, 87; Hull and Selby, 38, 70, 245, 289, 290; Lancaster and Preston, 178, 215, 290, 326; Lardner's, lectures on, 168; Llanelly, 254; London and Birmingham, 71; London and Dublin, report on, 190; London and Norwich, 398; management, 414; Manchester and Birmingham, 139, 178, 214, 290; Manchester and Leeds, 39, 103, 399; Maryport and Carlisle, 70, 290; Midland Counties, 139, 179; North Midland, 38, 103, 178, 214, 289; North Union, 326; Northern and Eastern, 214; Paris and Rouen, 215; pneumatic, 164, 253, 398; power, employed upon, 6, 63; Preston and Wyre, 214, 256, 290; Rangeley's 322, 372, 388; report of select committee, 137, 278; rope traction, 6, 213, 393; into Scotland, report, 241; screw jack, 386; Sheffield, and Manchester, 6, 70, 178; sleeper, cedar, 346; South Eastern, 2, 39, 179, 430; South Western, 71, 103, 215; speed on, 265; Taff Vale, 398, 430; telegraph, 279, 323; Thames Haven, 430; traffic, 278, 311, 376; trains, stopping, 429; water, power on, 393; West Cumberland, 241; West London, 164, 253, 398; wheel, Dirck's, 401; working expenses of, 174; York and North Midland, 290.
Ralph's Review of the Public Buildings of London, 199, 227, 263, 302, 339.
Rambles by Philomusæus, 4, 84, 155.
Refrigerator, Davison's, 211.
Report on harbours (South Eastern Coast) 236, 259, 321.
—— plans for preventing steam vessel accidents, 245.
—— railways, 137, 278.
———— London and Dublin, 190.
———— into Scotland, 241.
———— Belgian, 288.
—— steam navigation, France, 360.
—— Thames embankment, 382.
—— Trafalgar-square, 255, 286, 304.
Retort upon retort, 259.
Reviews—Architectura Domestica, 33; Bartholomew's specifications, 319; Bielefeld's papier mâché, 130; Brees's Railway Practice, 276; Brees's Glossary of Civil Engineering, *276, 393;* brief description of plans for supplying water to the *metropolis, 203; Bruff's Engineering Field Work,* 317, 354; Claxton's Memoir of a Mechanic, 31; *Comic Latin Grammar, 34; Companion to the* Almanac, 32; Cooley's Propositions, 130; Cooley's Euclid, 34; Cresy's Stone Church, 318; Creuze's Naval Architecture, 250, 277; Day's Parallels, 250; Egerton's Mexico, 351; France's Geology, *317, 394; France's Trignometrical Surveying, 34;* Gandy and Baud's Windsor Castle, 250; Gilks's *Wood Engraving, 130; Hann's Theory of Bridges,* 29; Heath's Picturesque Annual, 131; Kittoe's Illustrations of Indian Architecture, 203; Loudon's Arboretum, 102; Manchester as it is, 32; Mushet's Papers on Iron and Steel, 317, 390, 414; Nicholson's Guide to Railway Masonry, 34; ditto, Treatise on Projection, 250; Ornamental Gates of the Parks, 34; Pambour's Locomotive Engines, 415; Parkes on Steam Boilers, 100; Page's Guide to Ornamental Drawing, 130; Penny Cyclopedia, 203, 389; Practical Inquiry into the Laws of Excavation, 391; Radford's Construction of the Art, 174; Reid's Chemistry, 250; Rendel's Plymouth Railway, 393; Repton's Landscape Gardening, 52; Ricauti's Rustic Architecture, 207, 393; Richardson's Architectural Remains, 276, 320; Robert's Galvanism, 393; Rooke's Geology, 250; Royal Lodges, Windsor Park, 102; Scott's Practical Cotton Spinner, 393; Standish's Seville, 351; Tredgold's Elementary Carpentry, 102; White's Harbours of Refuge, 102; Wightwick's Palace of Architecture, 352; Year Book of Facts, 130; Young's Practical Arithmetic, 174.
River Erne, 343; improvement of, 284; Medina, 37; New, 291; Shannon, 288; Severn, 31; Thames, 258, 283, 359, 382; Trent, 398; Vistula, 210, 229.
Road, Perth to Elgin, 37; profile of, 385.
Royal Society, 22, 69, 93, 207, 247, 281.
Safety beacon, Bullock's, 345.
Saws, circular, 26.
Scientific Society, 426.
Screw jack, traversing, 50, 386; universal, 386.
Sculpture, Newton's, copying machine, 429.
Sea, depth of, 55.
Sewer, Fleet, 398.
Ship building, *vide* Steam-boat, iron lower deck beams, 398; French, 277; sliding keels, 349; iron, 388, 397; mast carrying, 430; form of vessels, 421.
Shot machine, 363.
Smoke, consumption of, 356.
Society of Arts, 10.
Statues, stone and bronze, comparison of, 355; Huskisson's, 86.
Steam as a moving power, 426.
Steam Boat, *vide* Steam Engine, accidents, 163; Archimedes, screw, 192, 252, 325; Alice, iron, 69; American, 117, 162; Atlantic, 37, 213, 361; Australian, 397; Brigand, iron, 288; British Queen, 37, 153, 177, 213, 325; canal, 398; Clyde, 430; Courier, iron, 212; Cyclops, 36; Dover, iron, 252; Duchess of Lancaster, 252; dredging, 430; Dahlia, iron, 325; Earl of Hardwicke, 325; East Indian, 286; Eclipse, iron, 292; Elbe, 212; Elberfeld, iron, 325; engineers, 69; engine, 73, 142, 153, 157, 159, 172, 212, 245, 358, 374, 385, 386; Enterprise, iron, 37; Father Thames, iron, 362; Ferry, 398; fire, extinguishing, 357; Fire King, 251; France, report on, 360; German, 213; Great Western, 3, 70, 153, 158, 213, 398; India, 325, 348; iron, 37, 69, 104, 177, 211, 212, 252, 288, 292, 325, 348, 362, 388, 397, 398, 430; ditto, durability of, 211; ditto and timber, comparison of, 348; ditto, testing of, 101. Junius Smith, 400; Lee, iron, 177; Liverpool, 213, 253; Mermaid, iron, 430; Mail, 177; Monarch, iron, 430; Mongebelle, 398; Nemesis, 70, 137, 348; Nonsuch, iron, 314; Oriental, 253, 325; Orwell, iron, 37, 104, 212. Paddles, Boulton's, reefing, 76; ditto, Hall's, reefing, 76; Peru, 287, 362, 398; Phlegethon, iron, 252; *Polyphemus, 397; power for long voyages,* 386; President, 70, 173, 176. Propeller, 397; *propellers, experiments on, 25, 49, 157; ditto,* new, 292, 430; Proserpine, 104; Pylades, 37; Queen Victoria, 212; Rose, iron, 397; Royal Mail, 253; Ruby, 251; sliding keels, 349; smoke, 170; Sons of the Thames, iron, 37, 104, 177, 212; Swallow, iron, 235; Swedish, 177; Thames floating engine, 325; Thistle, iron, 397; tug, 287; United States, 173; Vernon, 325; Warrington, iron, 430.
Steam Engine, *vide* Fuel.
———— boiler, Curtis's, 76; ditto, Poole's, *175; ditto, proving, 430; ditto, Moindron's im*provement, 327; ditto, clothing, cedar, 346;

ditto, ditto, patent felt, 367; ditto. incrustation, 397; ditto, water regulator, 291, 328.
—— condensation, 358; Cornish, 4, 133, 153, 282, 419; ditto, and Lancashire system of working, 4; Craddock's improvement, 396; East London Water Works, 7, 65; epicycloidal, Clark's, 87; explosion, prevention, 385; factory, French, 400; fires, lighting, 363; friction, 375; fuel, 134, 176.
—— furnace, Moore's plan for feeding, 162; ditto, smoke consumer, 216.
—— Huel Towan, 314; indicating power, 127; manufactory, Fawcett and Co.'s, 172; Fairbairn's, 32.
—— marine, 73, 142, 153, 157, 159, 172, 212, 245, 358, 374, 385, 386; ditto, Maudslay and Field's, 73, 157; ditto, trunk, Broderips's, 142, 159; ditto, ditto, Humphry's, 142, 159; ditto, employment of expansive principle, 153; ditto, oscillating, 212; ditto, accidents, report on, plans for preventing, 245; ditto, temperature of condensation, 358; ditto, long and short stroke, 374; ditto, power, 386; ditto, Alice, 385; ditto, Seaward's, 374; ditto, connecting rods, 424.
—— power, 28, 65, 100, 127, 170; rotary, 397; ditto, Moore's, 158; safety valve, 216, 251, 359, 385; smoke, consumption of, 216, 356.
—— theory of, by Mornay, 59, 149; vacuum, 164.
Steam fire engine, 431.
—— plough, 160.
Steam shot machine, 363.
—— solubility of silica by, 282.
—— vessel inquiry, 85, 108, 163.
—— washing machine, 28, 90.
Stone, bendable, 183.
—— new Houses of Parliament, 189, 309, 340.
—— Talacre, 209.
Storms, effect of fire in preventing, 39.
Survey, trigonometrical, 366, 431.
Surveying, azimuth cap, 315.
—— calculating balance, 21.
—— chain, Hindle's, 310.
—— change of pins, 379.
—— computation scale, 324, 379, 405.
—— copying drawings, 354.
—— irregular plots, instrument for, 55.
—— level, Browne's, 283.
—— poles, Dempsey's, 108.
—— railway curves, 15, 74, 128.
—— roads, profile instrument, 55.
Sang's hypsometer, 403.
Thames Tunnel, 216, 249.
Theatre, Adelphi, 394; Hanover, 162; machinery, Stephenson's, 363; Princess's, 394.
Tide gauge, 342, 394.
Tides of the ocean, 229.
Timber, dyeing, 183; effects of worm on, 424; felling, 341; prevention of decay of, 26, 27, 328; white cedar, 346.
Tottie, C., on the Napoleon monument, 406.
Turning, 172, 175.
Valve cocks, Topham's, 121.
Varnish of dextrine, 25.
Vessels, form of, 421.
Voltaic engraving, 35.
Walls, iron ties, experiments on, 41.
Warming and ventilating buildings, 358.
Water, *vide* Hydraulic, Steam Engine, Well, Pump.
—— Bourne, 103.
—— balance gates, East London Water-works, 42.
—— company, new, 250.
—— filter, 207.
—— plans for supplying the metropolis, 207.
—— power, application of 291.
—— raising engine, Adcock's, 279, 299.
—— Brighty's, 291.
—— Cornish, 419.
—— De l'Osier's, 51.
—— Fairbairn's, 412.
—— Hall's, 128.
—— Harvey & West's, 41.
—— Jeffrey's, 386.
—— Thames, analysis of, 192.
—— Weir, Broomielaw, 415.
—— wheel, vertical, Curtis's, 129.
Wells *vide* Artesian, 99.
Whitworth on surfaces of metal, 421.
Wicksteed on the supply of water to the metropolis, 10, 45; and the balance gates of the East London Water Works, 42.
Williams, C. W., on the combustion of coal, 412.
Wire fences, 48.
—— rope, 431.

INDEX TO PLATES AND ENGRAVINGS.

Ashton Court, 52.
Balance gates, 2 plates, 42.
Bank, London and Westminster, 1 plate, 73.
—— Savings, Finsbury, 217.
—— Union, 183.
Beams, trussed, 6 cuts, 161, 322.
Bielefeld's papier maché works, 8.
Boulton's reefing paddles, 2 cuts, 74.
Brick machine, Bakewell's, 160.
—— White's, 8 cuts, 184.
Bridge, Ardrossan, 29.
—— East London Water-works, 2 plates, 42.
—— iron, 162.
—— James River, 1 plate, 125.
—— Suspension, Dredge's, 1 plate, 193.
—— Victoria, Bristol, 193.
Buttresses, 4 cuts, 365, 366.
Capitol, Washington, 293.
Cathedral, Athens, 2 cuts, 220, 221.
—— Avignon, 2 cuts, 143, 144.
—— Freiburg, 329.
—— St. Paul's, 2 cuts, 329, 330.
—— Salisbury, 329.
Chapel, King's College, 329.
—— Unitarian, Dukinfield, 1.
Chatterton's monument, 3 cuts, 105.
Church, Arles, St. Trophime, 144.
—— Bow, 329.
—— Caen, St. Peter's, 322.
—— Monetes Koras, 221.
—— Panagia Lycodimo, 220.
—— Poitiers, Notre Dame, 221.
—— St. John, 144.
Church Ravenna, St. Vital, 219.
—— St. Bride's, 329.
—— St. Dunstan's East, 330.
—— St. Genevieve, 293.
—— Sergius and Bacchus, 220.
—— Stone, Kent, 8 cuts, 318.
—— Tours, St. Martin's, 143.
Cobham Hall, 53.
Cofferdam, 7 cuts, 79, 80, 81, 82, 83.
Column, General Clayton's, 181.
Cornice, Reform Club, 336.
Curtis's boiler, 2 cuts, 76.
—— ground-rope apparatus, 3 cuts, 87.
—— railway truck, 3 cuts, 5.
Custom-house, Liverpool, 3 cuts, 410.
Dempsey's surveying-poles, 3 cuts, 108.
Dublin Bay, 146.
East London Water-works, 2 plates, 42.
Electric telegraph, 323.
Elizabethan shop front, 1 plate, 257.
Embankment, Thames, 258.
Fairbairn's draining machine, 412.
Harbour, Ardglass, 146.
—— Beachy Head, Dover, Foreness, 1 plate, 240.
—— Kingstown, 146.
—— Lowestoft, 147.
—— Portrush, 146.
Hooper's letter weights, 88.
Iron furnace, Persian, 7 cuts, 296.
—— ties in party walls, 2 cuts, 41.
Lewis, 30.
Merchant Seamen's Institution, 1 plate, 251
Minaret, Armedabad, 329.
Pantheon, interior, 1 plate, 195.
—— Rome, 293.
Pavilion, Brighton, 53.
Piling, Telford's, 2 cuts, 29, 30.
Polytechnic Institution, 1 plate, 293.
Public road, 2 cuts, 54.
Pump, rotary, Sutcliffe's, 7 cuts, 273.
—— valve, Harvey & West's, 1 plate, 41.
Quay, Aberdeen, 29.
Railway, atmospheric, 1 plate, 260, 4 cuts, 407, 408.
—— Rangeley's, 1 plate, 372.
—— wheel, Dirck's, 5 cuts, 401.
Reform Club, 141, 4 plates, 336, 409.
Repton, portrait of, 52.
Safety valves, 2 cuts, 251.
Saug's hypsometer, 4 cuts, 404.
Ship-building, 5 cuts, 349.
Slide valve cocks, Topham's, 4 cuts, 121.
Steam-engine, Broderip's trunk, 2 cuts, 142.
—— Clark's, 2 cuts, 87.
—— Maudslay's Two Cylinder, 2 plates, 73, 2 cuts, 157.
—— rotary, Moore's, 148.
Surveyor's scale, new, 354.
Traversing screw jack, 50.
Warwick House, Birmingham, 1 plate, 104.
Water engine, Adcock's, 3 cuts, 299.
—— De l'Osier's, 1 plate, 51.
—— filter, 2 cuts, 203.
—— wheel, Curtis's vertical, 3 cuts, 129.
Wire fences, 6 cuts, 48.
Wyre Lighthouse, 182.

DIRECTIONS TO BINDER.

Plate 1.—Harvey and West's Patent Valves	opposite page	41
„ 2 & 3.—East London Water Works.	„	42
„ 4.—De L'Osier's Apparatus for Raising Water	„	51
„ 5 & 6.—Maudslay and Field's Improved Steam Engine with two cylinders	„	73
„ 7.—London and Westminster Bank	„	84
„ 8.—Bridge over the James River in Virginia	„	125
„ 9.—Warwick House, Birmingham	„	128
„ 10.—Dredge's Suspension Bridge	„	193
Plate 11.—Pantheon, Oxford Street	opposite page	201
„ 12.—Harbours of the South Eastern Coast	„	237
British Seamen's Hospital	„	251
„ 13.—Shop front in Oxford Street	„	257
„ 14.—Clegg & Samuda's Atmospheric Railway	„	260
„ 15.—Polytechnic Institution	„	321
„ *15 & 16.—Reform Club House	„	336
„ 17.—Rangeley's Rotation Railway	„	372
„ 18 & 19.—Reform Club House	„	409

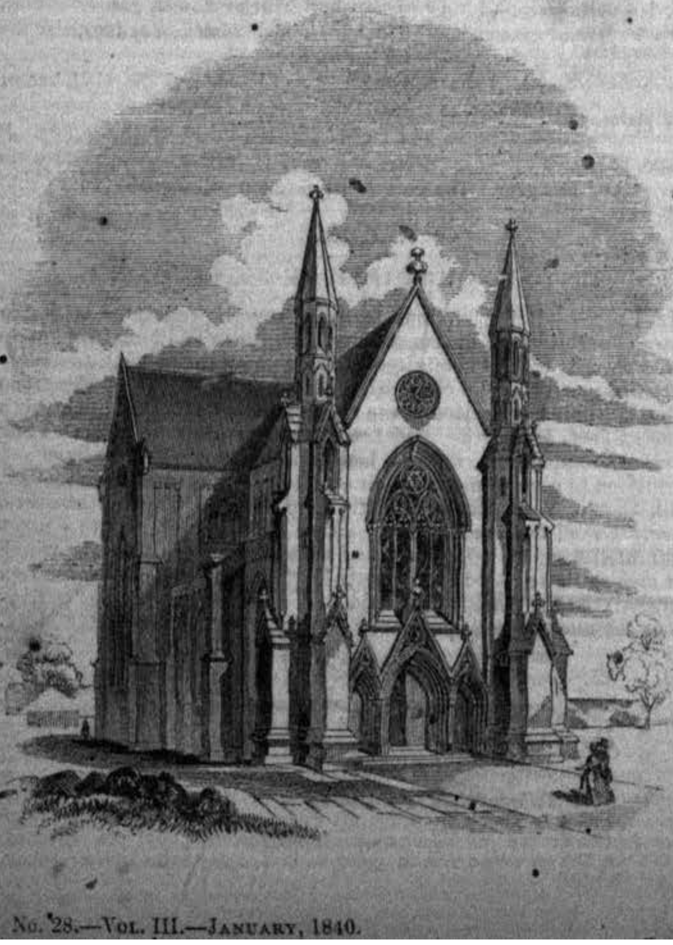
THE

CIVIL ENGINEER AND ARCHITECT'S

JOURNAL.

PRESBYTERIAN (UNITARIAN) CHAPEL AT DUKINFIELD.

Mr. R. Tattersall, Architect.



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ECCLESIASTICAL EDIFICES.

It is our intention under this title to give illustrations and descriptions of such new edifices dedicated to religious purposes, respecting which we can obtain information. We hope that this may serve as a stimulant in directing public attention to this now neglected subject, and particularly in rousing the self-esteem of members of the establishment. At present those entrusted with the erection of churches seem to consider it their first object to make as much pew room as possible, regardless of all other objects, on much the same principle as they would construct sheep pens—crowd the animals in, and care nothing for their comfort. Why does the church appeal so powerfully to the beautiful monuments built by our ancestors, why does she depend on that devotional feeling which the contemplation of our hallowed sites suggests, if she herself thinks it beneath her to keep up the dignity of the estate she has inherited. Oh! how eloquently can her ministers dwell on the solemn thoughts inspired by the long drawn aisles of our ancient cathedrals, how energetically can they remind us of our childish predilection for the ivy covered spire! but when it comes to the expenditure of the vast sums under their control, how totally do they neglect their favoured dogmas, how selfishly do they consult their own interests at the expense of the establishment of which they are members! Empirics are employed, the men who can do the dirty work cheapest, nothing is allowed for architecture, nothing for the decorative arts—the worthy pastors think they best consult the wishes of their flocks by making the sheep pens as numerous as possible. They totally forget that it is not their own money they are expending, but the produce of public grants or private benefactions; that they are only trustees, and that they are not to look to their own interests only, but pay some regard to the purposes for which the sums were received, for surely it is more gratifying to the donors to see a handsome edifice rather than the barn-like structures with which the public have been of late so abundantly annoyed. A Union Workhouse would beat most of the new churches hollow in almost every point of its construction. We can only say that unless the members of the establishment reform their system, they will be beaten by the other religions, Jews, Catholics and Dissenters all surpass them in elegance and costliness of construction, and surely their necessities are not less, nor their revenues more abundant. We regret indeed that one of our first examples, the Unitarian Church at Dukinfield, should be the work of Dissenters, and a shame to the dispensers of the public money. Sure without any parliamentary funds, without any rich endowments, and with but a small portion of the wealth of the nation, first rate talent has been employed, and a noble monument erected.

DUKINFIELD CHAPEL.

THIS chapel is now erecting on the site of the former edifice, (whose dilapidated condition and inadequncy in supplying room for the large congregation assembling therein, rendered the erection of a new and more commodious building absolutely necessary,) from the designs of Mr. R. Tattersall of Manchester.

The style of architecture which has been adopted for the structure now in progress, is that which prevailed at the commencement of the fourteenth century, when our architects began to add refinement in the details to the many beauties which characterise their works, and to introduce those changes in the early English style which immediately precede and ultimately form and distinguish the decorated style.

The plan of the chapel is cruciform, with a lofty nave and transepts lighted by clerestory windows, the nave having aisles lighted by lancet windows. The east and west ends of the nave project beyond the ends of the aisles; in the west projection are the principal entrances with a children's gallery over, whilst the east projection contains the vestry and private entrance with a gallery over affording ample room for a powerful organ and numerous choir.

The principal elevation into which it has been thought advisable to introduce whatever decoration might be used, consists of two octagonal turrets flanking the west wall of the nave, strengthened by massive double buttresses in three stages, the lower part terminating in weathered canopies, the middle having weathered offsets, and the upper being formed into niches, surmounted by canopies, uniting with the weathering of the turrets, and the parapet moulding of the west gable. The lower and upper canopies to the buttresses, are terminated by appropriate finials. At the termination of the buttresses the turrets become isolated and are continued in two stages to the base of the pinnacle, the lower stage having shafts at the angles with moulded bases and capitals supporting pointed arches, and in each face of the octagon is a narrow slit or opening in the form of the ancient *ballistraria*, whilst the upper stages have plain shafts at the angles, with a narrow lancet opening, having the tooth ornament in the hollow surrounding the same, on each face of the turret. The turrets finish with lofty pinnacles having shafts at the angles, and terminating in finials, the highest part of which will be 73 feet above the surface of the ground. One of these turrets will contain a bell, and the other is to serve for the clock weights. The turret in which the bell is to be suspended will contain a winding staircase for access to the clock-room in the roof the nave.

Between the turrets to the west front are three doorways forming the principal and gallery entrances to the chapel. These are boldly recessed, the centre door being much wider than the side ones, and are formed into one group by the arrangement of their shafted joints, moulded archivolts and the triangular canopies with which they are surmounted. The moulding over each canopy, unites with the hood mouldings of each door, and terminates upon carved heads, whilst the apices of the canopies finish with carved finials, the centre one being quite isolated in the opening of the window over. Each canopy is filled in with deeply cut tracery. In the hollows of the arched heads and between the shafts of the jambs, it is intended to introduce those very effective enrichments, known as the ball flower and leaf ornament and the tooth ornament. The three doors will be of oak, relieved by the quaint and beautiful ramified iron scroll-work so characteristic of this style of architecture. Immediately over the doors is a four light window formed with shafted mullions and jambs, and filled in with the rich and elegant tracery, which we find immediately preceding the flowing lines of the decorated style. The ball flower and tooth ornaments will be introduced into two of the hollow mouldings of the jambs and head, and the window will have a hood moulding terminating on carved heads. Above the window, and in the gable of this front will be placed the clock dial, which it is intended eventually to make transparent. This is in the form of a multifoil surrounded with bold mouldings, and in the intervals of the cusps will be placed the figures of the dial. The gable of this front which is very lofty, (as are all the others owing to the high pitch of the roof), is surmounted by a richly carved finial, and in the mouldings of the parapet the ball flower ornament is again introduced. The whole of the plain ashlar to this front is to be neatly tooled, but the moulded work and dressings are to be rubbed or polished. The remaining fronts of the building are of a much plainer and simpler character, and are to be faced with neat hammer dressed walling stones, the dressings being tooled. All the exterior of the chapel is to be faced with the best Yorkshire stone.

The sides of the aisles are divided into compartments by buttresses of an early character, having a single off-set, and uniting at the top with the parapet, which is supported between them by quaintly cut corbels, and finishes with a tablet or coping formed by the moulded cast-iron gutter. In each compartment of the aisle are plain lancet windows, with neat hood moulds terminating on carved heads. The transepts project some little beyond the sides of the aisles, and there external angles, as well as those to the east end of the nave, are flanked by plain buttresses of a similar character to those of the aisles, and divided into three stages with plain off-sets. The three gables are covered by a plain coping, terminating in canopies at the lower ends. In the gables to the transepts and east end of nave are openings for light and ventilation to the roof, and the same kind of corbels are introduced to support the parapet as are used to the aisles. In the end of each transept are triple lancet windows united together by their hood mouldings, the centre being higher than the side ones. The clerestory is divided into compartments by flat buttresses ranging with those to the aisles, surmounted by a parapet and coping of a similar description to those already mentioned. In each compartment are triple lancet windows having hood mouldings terminating on carved bosses. The principal entrance door opens into a porch or vestibule formed between the two staircases to the galleries, from which it is separated by screens ornamented with tracery, and having doors of communication. From hence, inner folding-doors open directly into the body of the chapel, which is divided as before described into nave and transepts, the former being flanked by aisles from which it is separated by light piers formed of clustered shafts, supporting on richly moulded pointed arches the clerestory walls, in which there is a narrow lancet window over each compartment. The aisles are also open to the transepts from which they are separated in like manner. The galleries will extend across the west end of the nave over the aisles and across the transepts. The nave and transept ceilings are to be groined throughout with moulded ribs on all the intersections of the vaulting, and against the walls, springing from corbels formed by clustered shafts affixed to the clerestory walls. The ceiling to the aisles is to be formed into neat plain panels. A neat screen extends across the east end of the nave in a line with the ends of the aisles, separating the vestry from the chapel, against which is to be placed the pulpit, to be entered from the vestry through an opening therein. The pulpit will have a highly enriched canopy or sounding board, and the whole is made to harmonize with the screen and the general character of the building. Around and beneath the pulpit, which is supported by a cluster of shafts, is the space allowed for the communion altar on a raised platform enclosed by a neat railing. Beyond the screen and over the vestry is the organ gallery, and it is intended that the front of the organ-case shall be made to assimilate with the screen as much as possible. At the opposite end of the nave, and over the principal entrance is a gallery capable of containing upwards of seventy children, leaving an uninterrupted view of the four light window in the west front. Vaults are formed under the west entrance, and there is a cellar under the vestry for warming the chapel with hot water.

The extreme length of the building will be 94 feet, and the width across the nave and aisles 50 feet, that across the transepts 61 feet.

The chapel will contain sittings for 977 persons, 194 of which are free. It is expected that it will be completed and ready for divine service towards the latter part of this year. The cost of its erection will be defrayed by subscription.

HISTORY OF BRITISH ARCHITECTURE.

MR. EDITOR—Being anxious to make myself acquainted with the history of architecture in this country, I regret to find how inadequate are the records hitherto collected by writers on the subject, to enable one to form an accurate conception of the vicissitudes of the art in England. This has excited in me the desire to collect such materials on the subject, as may be useful to my professional brethren. I beg therefore to appeal Sir, through you, to all parties who may have any information to give of men of such standing as Vanburgh, Hawksmoor, Gibbs, Carr of York, Morris of Bath, Kent, Gandon, Taylor, Chambers, Dance. I shall feel much obliged either by being referred to sources of information, or by being furnished with the lists of the works which such men as these may have executed. I of course confine myself to no period; on the contrary, I would wish to embrace the earliest, as well as the most recent, epochs of the history of English Architecture.

I am, Sir, very faithfully, your's,
THOS. L. DONALDSON.

7, Hart Street, Bloomsbury Square,
December 20, 1839.

South-eastern Railway.—The rapid progress of the works of the Sou eastern Railway is giving quite a lively aspect to Folkestone. The br across the Canterbury and Dover road is also completed; and the adv ment of the line on either side is going on in a highly satisfactory ma —*Dover Chronicle.*

CANDIDUS'S NOTE-BOOK.

FASCICULUS XII.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. From all the views and drawings I have ever seen of Abbotsford, I always considered it to be a very trumpery specimen of architecture, but I was not before aware of the exceedingly whimsical taste of Sir Walter Scott, until I saw the view of the dining-room given in the ninth volume of Lockhart's Life of him now publishing. Will it be believed that that dining-room contains one of the oddest and most impertinent pieces of furniture imaginable for such an apartment? Had it been a Rumford cooking apparatus or something of that kind, its convenience might have excused its oddity and homeliness, but what shall we say to a four-post bedstead in a dining-room? There certainly is no accounting for tastes; and the idea is a sufficiently original one. Perhaps it was intended as a refinement on the Roman mode of lying recumbent at table upon couches. But I trust that no one will think of imitating Sir Walter in that particular fancy of his, or people will henceforth strip and get into bed, instead of sitting down, to table. At least that should be a privilege exclusively confined to persons of genius,—not extended to ordinary mortals, good reader, like you and me. Well, there certainly must have been comical doings at Abbotsford, if such was the custom of the place; and we insignificant nobodies may be very well content with dining-rooms without beds in them.

II. The Abbotsford dining-room reminds me of the Scott Monument at Edinburgh. How is that getting on?—or how happens it that we hear no more about it? Is it, like the Edinburgh Parthenon, the monument of a monument that was to have been; or like the Nelson Monument in Trafalgar Square, altogether an imaginary, immaterial fabric, Certes, monuments are not things of mushroom growth.

III. We are, now it seems, all at once going to be filled with admiration of Inigo Jones; which is passing strange, considering that they abound with the very faults that are found unindurable when they occur in modern buildings. With what consistency of taste, those who are shocked at the impropriety of half columns and broken entablatures, can affect to see any supereminent beauty in his building at Whitehall, which has the further impropriety of an upper order above a lower one,—it is for them to explain. Possibly,—since they cannot but allow that the circumstances just referred to are egregious defects in themselves, they will assert that there are merits and excellences in his designs which amply atone for all their blemishes,—not to call them vices. That such is really their opinion must be taken for granted; but then, wherefore do they not vindicate themselves from the appearance of inconsistency, by plainly discriminating between the defects they reprobate and the beauties they admire, and informing us in what the latter consist? Or are we to suppose, that they are of the sort of critics extolled by Sterne for being pleased they know not why, and care not wherefore;—for which in my opinion no very great power of criticism is required? Perhaps Sterne was thinking at the moment, only of the kind of critics he himself wished for,—and there are others besides him, who look more to the quantity than the quality of the praise they get, but for my own part I would rather obtain the approbation of one critic who could tell why he bestowed it, to that of a score of others whose compliments seem to have no meaning, consequently carry with them no proof of sincerity.

However correctly and exactly general principles may be laid down, they can never be made to comprehend every specific application of them: but there will invariably be, more or less, something that, although based upon them does not obviously appear to conform to them, nay perhaps may seem at variance with them, on which account those who are not acquainted with the mysteries of art, becomes perplexed, and are at a loss to know whether they ought to censure or are at liberty to admire. It becomes the duty of criticism, therefore to elucidate such apparent contradictions, and in every particular case, to explain how it happens that the disregard of certain established rules may have been attended with beauty, or, *vice versa*, how the adherence to them has failed to secure it:—again, to point out wherein frequently consists the very great difference between two buildings, very similar as to style and design, yet altogether unlike in regard to the impression they make.

IV. Very far more stress than ought to be, is generally laid upon simplicity of plan. For my own part, I very much question it being a merit at all, when I perceive that so far from conducing to any beauty, it generally constitutes a defect, inasmuch as it excludes all variety and combination, together with contrivance. While it leaves nothing to the imagination, it does not present itself to the eye as a beauty the entire plan not being seen at once; nor do I understand what particular pleasure can be afforded to the mind, by knowing that with regard to the distribution and form of the several rooms there is nothing more than what has been seen over and over again. Nay, I will not be quite sure that I understand what is meant by simplicity in such cases: yet if it be meant that the plan is such that any stranger can at once comprehend every part of it, by merely going over the building at a single time, should say that so far there would be very little to approve or admire;—certainly no evidence of skill or ingenuity, and very little of either picturesque effect, contrast or variety, because where they do not result almost entirely from accident, they are produced by a study which aims at something more than mere simplicity of plan. While the latter tends to make a large house seem smaller than it is, a certain degree of intricacy and complexity causes a moderate sized one to appear considerably larger, especially where the arrangement is such that rooms may present themselves unexpectedly after we suppose that we have gone over the whole. Still there are limits to be observed: complexity ought not to be carried to perplexity; but some degree of the former greatly heightens every other merit.

V. It is odd; but now after the abuse thrown upon the poor National Gallery, because the rooms are no bigger than closets,—disgracefully confined and mean, some one starts up and assures us that they are utterly unfit for their purpose, because they are very much—*too large!* So at least says a writer in Blackwood's Magazine, who contends that spacious and extensive galleries, such as that of the Louvre are utterly unfit for showing pictures as they ought to be seen; and that the collection should be placed in small rooms,—not more than three or four paintings in each. This is surely running quite into the other extreme; but there certainly can be no doubt that as far as enjoying pictures themselves, and not the display of a parade of them, is the object, it is best obtained by hanging them so that each when looked at can be distinctly seen and examined, with nothing to distract attention from it.

VI. How people can reconcile themselves to windows without dressings in buildings where any degree of ornament or finish in other respects, is aimed at, is almost incomprehensible. Not even on the plea of economy has any one yet thought of entirely omitting capitals to columns, though it might be done with as much propriety and consistency; for if a window will answer all the necessary purposes of one, whether it be a mere aperture in the wall, or one properly defined and finished by its own architectural border,—so also will a column answer its purpose equally well, whether the top of it be fashioned as an ornamental member of it or not. Nor would it, though certainly more remarkable, be more solecistical and contrary to architectural principle to introduce columns without capitals among dressed windows, than naked windows among well dressed columns. Or if there be any thing to render the latter, and *more common mode less preposterous* than the other would be, it is because the columns themselves are generally quite *superfluous, therefore were their decoration* to be omitted, they might be dispensed with altogether. But then, on the other hand, *so much the more absurd is it to have recourse* to columns at all—at least for decoration,—under circumstances which *forbid not only corresponding embellishment, but even ordinary* finish in any other respect. Next to omitting window dressings entirely, is *the fault of making them so poor and plain as to* be hardly visible, as is the case in many of our modern Greek buildings, in which the *dressings to the windows consist of a mere border* distinguished by an insignificant moulding around it, so as to occasion equal sameness and insipidity.

The Great Western Steam-ship.—This noble vessel, the pride of Bristol and the queen of the ocean, was brought up the river on Saturday morning, 1st ult, and is now in Cumberland Basin, preparatory to her being placed in dock and undergoing various alterations, and for general examination and repair. During this week the public have had the privilege of viewing the interior of this splendid steam-ship on the payment of sixpence for each person, the receipts to be equally divided between the General Hospital and the Infirmary. We understand that nearly 2000!! persons paid to inspect the vessel on Monday, and many hundreds on each following day. This is the first time she has entered the dock gates since she left for London, to receive her splendid and powerful engines; her paddle wheels have been removed to enable her to enter the gates. Her approach to the basin at seven o'clock last Saturday morning was announced by the discharge of cannon, &c. The reception she met with upon arriving (at the dock gates) was very enthusiastic, arising from the loud and deafening shouts which emanated from the persons assembled "to do honour to her appearance." It is intended for her to resume the station she has so ably and successfully filled, on Saturday, the 15th of February, 1840, which will be the commencement of her twelfth voyage across the broad Atlantic.—*Railway Magazine.*

RAMBLES BY PHILOMUSÆUS.—No. IV.

LANDSCAPES ABROAD.

WHATEVER advantage foreign nations may derive by the education of the eye to beauty from the contemplation of objects of art, it is pretty certain that they will not easily surpass us in the scenes of nature. They may possess the same or finer outlines, they may bear the palm for correct drawing, but it is to us they must concede the chiar'oscuro, and what disputes with drawing itself the magic touch of colour. To carry out our artistical allegory, foreign landscape is of an Eginetan cast, severe and correct in its form, but destitute of that animation and finish which mark the later and more cultivated school. It is perhaps from the contemplation of our highly finished scenes, that our painters succeed in colour, and show such proficiency in landscape and cattle; that our poets excel in the descriptive; and that whatever is rural with us, is beautiful without coarseness or rusticity.

An Englishman passes from the tertiary scenes of our beautiful south, to the assimilated district in the neighbouring country of France, he can recognize the same smooth slopes, the same gently swelling knolls, the same richness of soil, and the same softness of character, but he finds a tameness, a want of animation and relief both in broad features and in details, which tell him at once that he is in another and a foreign country. He glides down the beautiful Seine and from St. Germain to below Rouen he perpetually finds a country spoiled from want of care, and a district of great capability wearing the face of a comparative desert. None of the bright fields of his native land, none of its varied and picturesque timber, no beautiful cattle spreading over the distant scene, he misses the hedge and the hedge-row, and above all he misses the dispersed population, the pretty seat or the lowly cot. Instead of these he finds no houses but in villages, little meadows and no variety of timber. From St. Germain to near Havre, there is nothing hardly to be seen but poplar, alder and willow, miles in length of distant forest, or long lines of well drilled poplars spreading along the roads or the divisions of estates. Now the maypole-like poplar is just the very last tree to be paraded thus in single file. The scenery has all the uniformity of foliage of American landscape, and there is only beauty enough to cause the traveller to regret that the whole does not show to equal advantage. On approaching Elbeuf, however, the scene changes, green meadows make up the foreground, the mottled cattle swarm among the pastures, oak and other dark trees, firs and the coniferous tribes, throw shade into the landscape, and the traveller as he looks at the tree-clad hills and grassy slopes is glad to find himself in a land of beauty.

In Flanders we find the same—long ranges of deformed limes and horse chesnuts making the straight roads more horrid, the brooks fringed with pollard willows, poplars like Cleopatra's needles running in lank rows as divisions of property, Scotch firs in patches to fertilize the land, and without meadows, water or cattle, one scene of stiffness and formality. The unhappy trees too are topped off into mopsticks so as to render horror more horrid.

The Dutch, however, if they have a poor country have a rich green sward, the weeping willow, and fine cattle: and an Englishman if he finds little to relieve, find no nakedness to distress the eye.

COMPARATIVE EFFECTS OF THE CORNISH AND LANCASHIRE SYSTEM OF WORKING STEAM ENGINES.

SIR,—As it is not now disputed by any one, that the Cornish or high-pressure expansive system of working the Boulton and Watt engine is more economical than that usually followed in the manufacturing districts, it may probably be interesting to a portion of your readers to have offered to their notice, an easy method of stating or comparing the duty or effects obtained by the two systems, for the purpose of shewing hereafter, the *amount* of saving that may really be expected by the adoption of the Cornish system; and also to have that saving expressed in terms that are generally understood and admitted by practical men.

The following cases are selected, because they have been recently laid before me for the purpose stated, by parties who are interested in having a careful examination of the subject, and who have also furnished me with the facts.

The engine from which the data for the Cornish system are taken, is that lately erected for the East London Water Works Company. The cylinder is 80 inches in diameter, stroke 10 feet, speed 10 strokes a minute, and doing a *duty* of 72 millions of pounds raised one foot high for one bushel, or 94 pounds of coal, the steam being cut off at two-fifths of the stroke. The area of the cylinder, of course, is 80 × 80 = 6,400 circular inches. The load on the piston is obtained by taking the counterweight which is 29 tons, or 64,960 pounds, and adding thereto half a pound per circular inch, or 3,200 pounds for the friction of the engine itself, making 68,160 pounds for the total gross load; which gives 10·65 pounds per circular inch, for the average pressure of the steam in the cylinder. The velocity of the piston being 10 × 10 = 100 feet a minute; the pounds raised one foot high per minute, will be 68,160 × 100 = 6,816,000, and the gross horse power exerted, is this number divided by 33,000, or 206·54 horses power.

The Lancashire system is illustrated by a pair of double acting sister engines working in a cotton factory in this country, and attached to the same crank shaft. Each engine has a cylinder of 40 inches diameter and 4 feet stroke, and makes 25 turns in a minute. The gross consumption of coal at the factory is 46 tons a week, the engine running 69 hours in that time. That portion of this consumption used for other purposes than working the engine, is usually estimated at 30 per cent., which includes that for steaming the factory, getting up the steam every morning, waste during meal times, &c. (particulars of which are given in the new edition of my work on steam boilers,) leaving about 32 tons or 71,680 pounds for the net consumption of the engines alone. The area of each cylinder is 40 × 40 = 1600 circular inches, the average pressure of the steam in the cylinder as taken by the indicator is 10 pounds per circular inch, and the whole load on the piston is 1600 × 10 = 16,000 pounds, which, of course includes the friction of the engine. The velocity of the piston is 4 × 2 × 25 = 200 feet a minute, therefore the pounds raised one foot high per minute, is 1,600 × 200 = 3,200,000; and the horse power exerted by each engine 96·96, or a total of 194 nearly.

COMPARATIVE DUTY.

	Lancashire.	Cornish.
a, Pounds raised one foot high per minute	6,400,000	6,816,000
b, Gross horse power exerted . .	194	206·5
c, Consumption of coal per week of 69 hours, in pounds . $= d + 69$	71,680	36,804·6
d, $= c \div 69$, ditto per hour $= e + 60$	1038·8	533·4
e, $= d \div 60$, ditto per min. $= a \div f$	17·31	8·89
f, $= a \div e$, Pounds raised one foot for each pound of coals $= g \div 94$	369,728	765,957
$g = f + 94$ Pounds raised one foot high for 94 of coals . .	34,754,432	72,000,000
$d \div b$, Pounds of coal consumed per hour, for each horse power .	5·35	2·58

The letters in the above table indicate the mode of calculation, and it will be perceived that the results in the second column (except the two first lines and the two last,) are obtained by reckoning from the bottom of the column upwards. It must be borne in mind that the horse power exerted by the factory engines as stated above, includes that required to turn the whole of the shafting, about one-third of the whole, which reduces the *net* effective power expended in turning the machinery to $(194 - \frac{194}{3}) = 129\frac{1}{2}$ horses nearly, or $64\frac{3}{4}$ horse power for each engine, and making the consumption of coal equal to half as much more as before, or $(5{\cdot}35 + \frac{5{\cdot}35}{2}) = 8{\cdot}02$ pounds per horse per hour. What the net effective power of the Cornish engine is, of course, cannot be ascertained without measuring the water delivered, but it is not at all necessary for the purpose of this comparison.

Should the above be considered a fair method of stating the subject, and it is respectfully submitted to the correction of the advocates of either system, I shall be glad, with your permission, to go into the question of the *causes* concerned in producing the great difference observable in favour of the Cornish system, and also the comparative cost or expenditure of fixed capital for the two kinds engines when doing an equal quantity of work, with a view to t the propriety of adopting the Cornish system in cotton factories.

I am, sir, yours, &c.

R. ARMST

Manchester, Dec. 1839.

CURTIS'S PATENT RAILWAY IMPROVEMENTS.

RAILWAY TRUCK.

Fig. 1.—Side elevation.

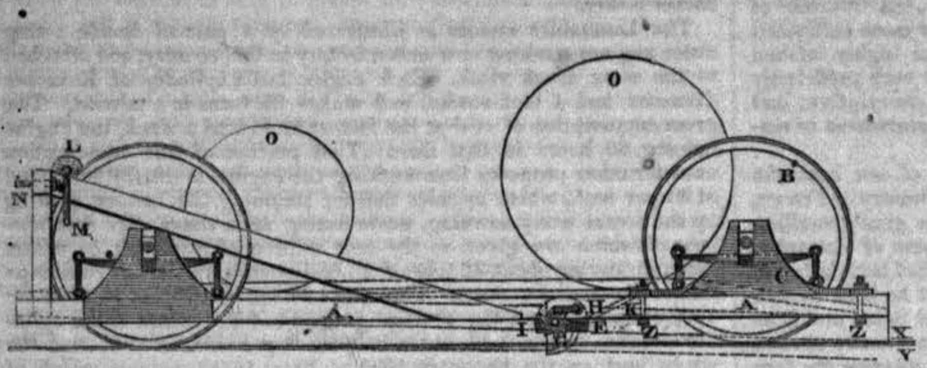


Fig 2.—End elevation.

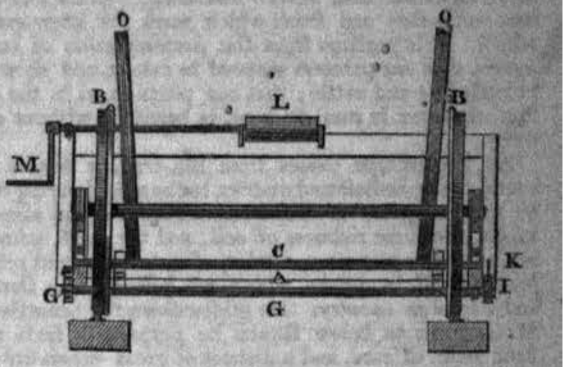
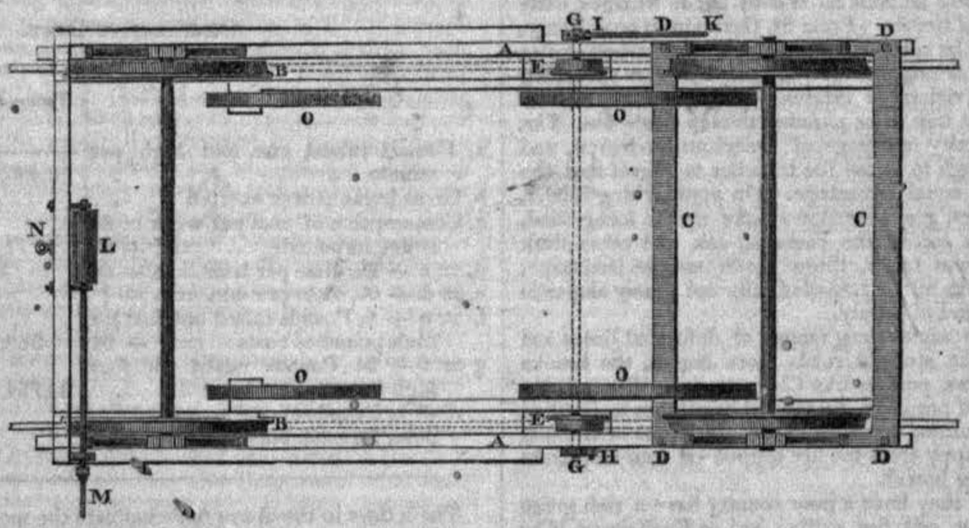


Fig. 3.—Plan.



DESCRIPTION.

Figure 1 is a side view, figure 2 an end view, and figure 3 a plan of the machine, the same letters refer to the same parts of the machiue in each figure, so far as the parts are thown in each. A is the framing of the machine, which is suspended below the axle in the usual way, B the hind wheels connected with the shifting frame C, which frame is held in its place by the bolts DDDD, or by any other usual and suitable means. EE are two eccentrics hung upon the cross shaft F, upon one end of which shaft the ratchet G is hung, and upon the other the head I, into the holes of which the lever K is inserted, when it is required to turn the shaft F round, so as to bring the eccentrics into contact with the rails or otherwise. L is a windlass placed upon the front bar of the machine round which a rope coils, so that when a carriage is required to be placed upon the machine, one end of the rope is made fast the carriage, and the other end to the windlass, then a man turning the windlass round by means of the handle M, the cariage is drawn upon the machine; the machine is connected to the train by means of the coupling N in the usual way, and the diagonal bars are placed as shown, in order that the concussion of the train may be transferred to the main frame of the machine A. OOOO are the wheels of a carriage placed upon the machine, the body and carriage is omitted in the drawing, as it is not material to the explanation of the invention that they should be shown.

The mode of operation is as follows:—when a carriage is required to be placed upon the machine, the eccentrics are brought upon the the rails and made to occupy the position shown by the red lines in figure 1, the effect of which is to raise the end of the carriage to which the shifting frame and wheels are attached, a space equal to that included between the shaded line X and the red line Y, and to support it whilst the frame C and wheels B are withdrawn, then the eccentrics are turned back until they occupy the position shown in the drawing, when the end of the machine is lowered to the ground and occupies the position shown by the blue lines ZZ. The carriage is then brought to the machine, the rope from the windlass is made fast to it, the floor of the machine being formed into an inclined plane, the carriage is dragged upon the machine by the windlass with great facility, when placed upon the machine the eccentrics are again brought into the positions shown by the red lines, which raises the end of the machine, the shifting frame C and wheels B are connected with the machine, and made fast by the bolts D, the eccentrics are then brought into the position shown in the drawing, riding clear of the rails; the ratchet G and paul H are provided to retain the eccentrics in any position they may be placed in, the best way to effect all these operations is to place the machine upon a turn table, the fore wheels and the eccentrics being upon the table when the machine can be disengaged from the wheels and placed to receive the carriage in a very simple and easy manner, the same operations apply if the machine is employed for goods or cattle, or any other purpose.

REMARKS ON RAILWAYS,

WITH REFERENCE TO THE POWER, &c. EMPLOYED UPON THEM.

SIR—This subject has occupied my attention for some time past, but I have been more particularly led to address you by seeing the description of Mr. Curtis's endless rope apparatus, in the last number of the Journal.

It has often been a subject of surprize to me, that so few attempts have been made to limit the enormous outlay of money in forming modern railways. When almost every branch of mechanics, manufactures and the arts are receiving the attention of scientific men, and when patentees without number are enabling us to do that for sixpence which used to cost us a shilling, ought we to be satisfied with expending all our ingenuity in examining the relative merits of brass and copper tubes, or in ascertaining the best form for rails and chairs, I think not; and though Messrs. Stephenson, who are unquestionably the first railway engineers, may tell us, that without locomotive engines, railways would be nothing, and though by this craft they have their wealth, yet nothing daunted, I will give you my ideas on the subject. We will suppose, for example sake, a railway is to be constructed from one town to another, say from Sheffield to Manchester, where the country is so hilly as to require a summit of upwards of 900 feet, and a tunnel 3 miles long, where the inequalities of the ground are such as to require embankments and cuttings in some places of 9 or 100 feet, and in many of 40 or 50, in order to make it at all suitable for locomotive engines to travel upon. We all of us know, that under ordinary circumstances, 50 feet per mile require the engines to be nearly three times as powerful as those which would be required upon a level, consequently, three times the weight of coke and fuel, as well as a great addition to the weight of the engine and tender, therefore, it becomes a question of some importance to ascertain whether a cheaper power cannot be adopted than locomotive engines. About ten years ago, Messrs. Walker and Rastric gave it as their opinion, that Mr. Thompson's plan of reciprocating ropes would be found more economical for the Liverpool and Manchester railway than locomotive engines. And be it remembered, this railway is uncommonly favourable for locomotives, compared with nearly all the others in England, with the exception of the two inclines. The only advantage gained by locomotive engines over the stationary system, since their report, is economy in the consumption of fuel, by having tubes instead of a large flue, and though this is a very great improvement, how is it that with a consumption of fuel not one-fourth of what was anticipated, we are told they cannot afford to take goods so as to leave a reasonable profit. The only solution to this problem is, that the expense incurred in levelling and forming railways, so as to make them fit for locomotive engines, together with the original cost, wear, and tear of locomotive engines, tenders, and rails, is such as to demand a larger toll upon the goods than can be afforded. Not to weary your readers by going into calculations, I will assert that the plan of endless ropes will be found in the case of the Sheffield and Manchester railway, or any other railway, with one continued rise to the summit of 35 feet rise to the mile, to be far more economical and efficient than locomotive engines. If we reject locomotive engines, the face of the country will not want excavating or embanking, excepting in a very few cases, which will save probably one-half of the original outlay, viz. £400,000., and the interest of this at 5 per cent., which is £20,000. per annum, will be saved to the shareholders; other things being the same, and that other things are as favourable must be our next business to prove. Any person acquainted with the country in question, will admit that reservoirs may be formed and water collected to almost any quantity, (of course without injury to the mill owners,) at or near the level of the summit, for a trifling expense,, which will furnish us with sufficient power without having recourse to locomotive engines. We will pass over the intermediate steps of engine-houses, water-wheels, &c. from an anxiety to keep these remarks within reasonable limits, and not from an inability to go into them. The principal objections to the reciprocating plan, or any other plan with ropes I have seen, are that the trains must all arrive together, stop at the stations to be hooked on and off, and in some of them cross over to the other rails. We will not dwell upon these objections, but provide the remedy, which is to divide the line into lengths of one mile each, and to have a station at the end of each mile, these will be divided into two kinds, the first contain the engine, water-wheel, or whatever the power may be, and are placed every other mile; we will call them No. 1, 2, &c. The second stations are, where the two drums, or large pulley wheels are placed, and occur every other mile, being placed halfway between the first mentioned, we will call these A, B, &c. From one of these stations to the other, extends an endless rope of two miles long, or one mile from wheel to wheel; one end passing round one of the wheels at the numerical stations, and the other round one of the wheels at the alphabetical, there being two wheels at each station, capable of working in concert, by means of which two endless ropes can be worked by one engine in both directions. It is not intended to work more than one at once by one engine, but only to give a signal to the man at the station No. 2, that he must set the engine or water-wheel going, and at the same time it is intended to couple them so as to ensure a uniformity of speed between the two ropes, before the train changes from one to the other, therefore one engine will be working at each end for a short time, there being two endless ropes coupled together working between them. This system of signals to be observed throughout the line; the object of it is to prevent any jerking or breaking of ropes, &c., as there are no stoppages at the stations, the first endless rope being liberated and the second taken when the train is at full speed. The way this is done is by a long iron bar fixed obliquely in the ground near the rope, nearly in the same direction, and as the first carriage passes over this bar, one side of the claws or holders of the rope, slides along the bar and is forced open, which liberates the rope; the impetus of the train carries it forward to the rope at the second station, (twenty or thirty yards would be sufficient,) where another bar fixed in a manner similar to the bar already described, again opens the claws, and a fork likewise fixed in the ground under the rope by the same operation, throws the rope between the claws, they close upon the rope and the train proceeds. The relative distance of claws, bars and rails being always the same, this part of the machinery can never get out of order, nor require any superintendance.

To elucidate the system proposed still farther, we will suppose a train is about to leave one end, when none of the ropes are in motion, it is first brought along the railway a little in advance of the station No. 1, then a pair of claws fixed on the first carriage, (which open by a lever and close by a strong spring,) grasp the rope, but without injuring it. The water-wheel or engine is then put in motion, and along with it the drum or pulley-wheel, endless rope, and consequently the train. The speed is got up to the maximum, and thus it proceeds till it arrives within 200 yards of the station A, being the first half-way station. The man at this station by a conical coupling, spring coupling, or in any other manner, which will gradually effect the same, connects the pulley-wheel of the first endless rope, or the one already described with the pulley-wheel of the second endless rope. The second endless rope is set in motion, and by this signal, viz. the moving of the rope, the man at the station No. 2, puts on the power, and before the train has got to the second rope, the speed of the rope is the same as that of the train. As soon as the man at the Station No. 1 judges the train has left the first rope, he takes off the water or steam, and the first endless rope leaves off running. It is not needful to describe the trains' progress forward, for the same thing occurs at every change. It is evident from the foregoing description, that the going train always keeps to one side, and the coming train to the other, and as the rope is the propelling power, or means of power, one carriage can never overtake another. A carriage to be taken up at any place on the line, may either be done in the manner described by your correspondent, or by an incline, to set the carriage in motion long enough to get up its speed before it is fixed to the train. In conclusion, I will make a few general remarks; upon considering the subject, two important facts force themselves into view;—the first, that almost any number of undulations may occur in the line of the railway, provided there be no convex curves in the section of the ground in the space of one mile, (concave curves would not signify, for they would diminish the friction of the rope rather than add to it.) The second is, let the country be as mountainous as the Simplon, railways may with advantage be made over it, provided there be a considerable traffic. The first of these will enable us to make railways at one-half the cost of the present system, the other to choose our own ground, and not be obliged to go in a particular direction or level, to suit locomotive engines, leaving large towns entirely out of view.

Here we can have a railway at one-half the expense of the other, at one-half the wear of rails, have no collisions between trains, and at no greater annual expense, but we won't have it;—and why? because if such a thing were attempted, Demetrius and the craftsmen, (and they are a very powerful body,) would run about the share-market and shout with a loud voice, "great is Diana of the Ephesians," and all the directors and shareholders in the railways already made, would stifle all argument with the cry of "great is Diana of the Ephesians," and at last, like poor silly sheep going to the slaughter, the projectors of and subscribers to contemplated railways, would join in the cry, and louder and fiercer than any shout "great is Diana of the Ephesians—great is Diana of the Ephesians."

Sheffield. DIOGENES.

(To be continued.)

PROFESSIONS IN FRANCE.

"They do these things better in France," has been echoed by Sterne's Starlings almost for the last century, and that we may enable our readers to pick out what good they can, and eschew the evil, we have thrown together some notes, based upon official documents and upon the almanacks and directories. With regard to the directory, by the bye, it comes from the hand of an editor with many tails, and is dated in the 32d year of the publication, and in the 10th year of our reign, or as it phrased *X^e de la continuation par l'Editeur actuel* (*Editeur*, usually means publisher.)

We shall throw our notes together just as they come, and leave their connexion to the industry of our readers. One of the first things that strikes us, is a dealer in essence of mahogany *(essence d'acajou,)* though what that is, we do not know. The list of country architects is, to a great degree, filled up with surveyors, as they are there called *geometres du cadastre*. Among the cement dealers we find Impermeable Mastic Powder of the Romans, Stone-coloured Mastic, Adialyte Roman Cement, Lucidonic Colour, Economic Bituminous Painting, (we presume tarring fences,) Hydrofugic Mortar, Hydróphyluctic Mortar, &c. One brick-maker has an establishment for making moveable terra cotta letters for shop boards; the master carpenters are formed into a body by a police ordonnance of the 9th December, 1808, for internal government, for inspecting the solidity of buildings, and for preventing pieces of carpentry from being placed so as to cause fires. Their tools must be stamped with a punch bearing their family name at full length; no journeyman must work on his own account beyond two days, without a previous declaration at the Prefectore of Police. Oh, blessed state of affairs! when shall we have the advantage of protection from the authorities of Scotland-yard, and be under the enlightened directors of the nearest station-house. The masons and locksmiths enjoy the same privileges; the paviors also, by a police ordonnance, are prohibited from undertaking any work without being inscribed at the Prefectore, and having their tools stamped with their names.

The number of well borers is ten; designers of bronzes, carpets and ornaments, ten; designers of paper hanging, twenty. There are several offices for doing specifications, drawings, measurements, estimates, &c. The gas fitters are twelve. Of engravers, there are in mezzotinto nearly a hundred; architectural, twenty; topographical, thirty; in wood, twenty; for paper hangings, ten; of lithographers, fifty. The engineers are all government functionaries, dispersed over the provinces, except about thirty civil and practical engineers at Paris. The steam-engine makers are six-and-twenty; the modellers, eleven; moulders of effigiés, fifteen; mosaic factories, five; scene painters, seventeen; decorative painters, fifteen; painters of artificial marbles and woods, thirty; glass and enamel painters and gilders, thirteen; platina manufacturers, twelve. The surveyors are about two hundred and fifty in number.

The next portion of our subject, will be the immense mass of government functionaries, one of the best tests of professional independence, whatever it may be of national encouragement. The first that comes in our way is the royal household, direction of crown buildings, with thirty-three architects of all grades. The next is the private domain of the king, with another board of architects. We then have the home department, directors of public buildings and monuments, with twenty-one employers of the general board, and a hundred and five district functionaries employed in different public works. The Prefecture of the Seine, almost equally prolific, has about a hundred and fifty. The Prefecture of Police has also a number of good births—the division of architecture alone, sixteen.

The engineers come off as well. In the war department, they are, of course, well provided for; but the ministry of public works, is their great support, there are to be found the names of fifty. In the Prefecture of the Seine, about as many.

COMPETITION DESIGNS.

Sir—You will perhaps favour me by inserting the following in an early number of your useful Journal.

Derby, Your's respectfully,
13*th Dec*., 1839.. B.

Two advertisements for designs have appeared in the "Times" this month, one for laying out 25 acres of ground near Ipswich, for which premiums of 30*l*., 20*l*., and 10*l*. were liberally (?) offered; the designs to be sent in by the 30th of this month! The other design required was for the Lincoln Diocesan School, to accommodate 200 boys; with a master's house attached, to have accommodation for 40 boarders, which was to be furnished by the 17th of this month (!) the board to assemble on the 18th, to make their selection (!!!) A short time since, designs were requested for a gaol at Peterborough, which were to be sent in by *twelve o'clock* of the 30th November, *when* the magistrates would meet to select the design! These last two cases, if the designs were really selected at the time announced, form a beautiful contrast to the dilatoriness of which Mr. Dionysius complains in the Sunderland Athenæum committee. The gentleman, Mr. Billington, whose design is adopted by that body, is an architect, surveyor, and civil engineer, as well as joiner and builder, in Wakefield.

It may be satisfactory to the "young architect" to know that tenders for the works were advertised for certainly three months since, as he may ascertain by reference to the "Leeds Mercury" of about that date.

The exertions of the Manchester Architectural Society are entitled to great praise from the profession. It is their intention, with the concurrence of the competing architects, to exhibit the designs for the Lancashire Independent College, which were advertised to be sent in by the 19th of October last. The building to cost £12,000.

Of the favourable result of such exhibitions, I am very sanguine—as they will awaken an interest in, and a taste for architecture among people in general; besides acting as a check upon the judges in competition.

But what are the Institute and the London Society doing? It is now three years since the first part of the first volume of the "Transactions of the Institute" appeared. Are we to have no more? The non-appearance of part the second does not speak *volumes* in favour of the interest of the communications that the Institute has received; unless, indeed, the publication of the Transactions was a failure. As to the Society, as far as we provincials are concerned, it is perfectly barren. Why do not *they* follow the example of the Institute, and throw open *their* competitions to the profession at large?

I consider that the Institute might exert itself very beneficially on behalf of the profession, by interfering in competitions.

I suggest that a sub-committee be appointed, which might be called the Competition Committee, whose business it would be, when designs are advertised for, to direct the Secretary to obtain particulars; and should they consider the time allowed too brief, or the premium too small, to urge upon the parties advertising the desirableness of increasing either. By thus bringing the matter home to the different bodies, I apprehend that the profession would be generally thought more respectable. The exertions of such a body, would be more likely to succeed than the isolated efforts of individuals.

To parties about to advertise, if requested, the Committee might furnish many useful hints. In addition to this, they might have exhibitions of the designs in remarkable competitions, and thus obtain some increase to the Institutes' income.

If, following the example of the Useful Knowledge Society, they would appoint local committees throughout the country, they would have their trouble lessened, and would unite the profession more intimately than it is, These committees, it is evident, may collect much useful information; as every provincial architect is not *personally* acquainted with these metropolitans, It should not, I think, be considered essential that the local committee be members of the Institute, but provincial architects, of whose professional standing the council was satisfied, might be requested to act. Though these suggestions may not meet with approbation, I must regret that neither the Institute, nor the Society, have opened an exhibition of the Royal Exchange designs. The gods will not help them who will not help themselves, neither will the world assist an apathetic profession.

It is to hoped that the Liverpool Society will exert themselves to obtain an exhibition of the Assize Courts designs; though the non-exhibition of the designs for the St. George's Hall argues a great deal of inactivity or apathy on their part.

That competition seems to have reached a satisfactory conclusion, For, though some may think that a better design might kave been selected, nobody will question the honourable conduct of the "Liverpool gentlemen."

B.

COMPARATIVE POWER OF STEAM ENGINES.

The following calculation by Mr. Wicksteed, the engineer of the East London Water Works, exhibiting the saving of fuel to be effected by using a single acting, expansive engine and an overshot waterwheel, instead of a double-acting condensing engine of the ordinary kind will be found interesting. This was made at the request of His Excellency Edhem Bey, ambassador from the court of Egypt, upon his late visit to this country.

A double-acting low-pressure engine of the ordinary construction of 50 horses power for spinning cotton, will consume from 10 to 15 lbs. of coal per horse power per hour, say on an average 12 lb. This is, however, a low estimate for Lancashire, where the consumption is generally much greater, coal being there less expensive than in several other parts of England. If we allow 311 working days per annum of 12 hours each, we shall have the total consumption of the above engine for one year = 50 × 12 × 12 × 311 = 2,239,200 lb. = 999 tons, 12 cwt. 3 qrs. 12 lbs., say 1000 tons at 50*s*.* = £2500.

A single-acting expansive engine on the Cornish plan of 50 horses power, if used for raising water to turn an overshot water-wheel, will not produce a power of 50 horses available for working the cotton machinery, since the effect of the water, when applied as a motive power, through the medium of the overshot water-wheel, will not exceed 66 per cent. of the power required to raise the water. Now 66 : 100 :: 50 : 76 = the number of horses power of the engine which will produce the same mechanical effect by this plan as by the usual mode.

A Cornish engine of 76 horses power will consume from 2 to 2½ lbs. of coal per horse power per hour, say 2½ lbs.; thus the consumption for one year will be equal to 76 × 2·5 × 12 × 311 = 709,080 lbs. = 316 tons 11 cwt., say 317 tons at 50*s*. = £792 10*s*.

COMPARISON.

The cost of coal per annum by the common mode is	£2500	0	0
Ditto by the proposed mode . .	792	10	0
Saving per annum = 68 =	£1707	10	0

The irregularity of the action of the steam in ordinary low-pressure engines is very nearly counteracted by the use of a fly-wheel; nevertheless, in some of the cotton factories, (for instance, that of Messrs. Lane, of Stockport) two engines are employed to work the same machinery, the cranks being fixed at right angles to each other, as in marine engines. Shis arrangement equalizes the action of the steam still more, yet the motion is not so regular as that of an overshot water-wheel, where the supply of water is uniform, as it would be in this case, the speed of the engine being regulated by the use of the cataract, to any given number of strokes per minute, and the delivery of water consequently uniform.

It should be observed that no large quantity of water will be required, as the same water may be used over and over again with very little loss.

When this calculation was made, very little practical knowledge of the consumption of coals for a Cornish engine in London had been obtained, and although we have never disputed the reports from Cornwall, yet many engineers of great experience had doubted the correctness of the accounts from Cornwall; it has now, however, been proved that the great engine lately erected by the East London Water Works Company at Old Ford, does not consume upon an average more than $2\frac{6}{10}$ lbs. of coals per hour per horse power, and as the coals used are the refuse of Newcastle coals, the largest piece not being greater than ¾ inch in diameter, we can have no doubt that Mr. Wicksteed's estimate of 2½ lbs. of coals per hour per horse power of *large* coals may be safely relied upon.

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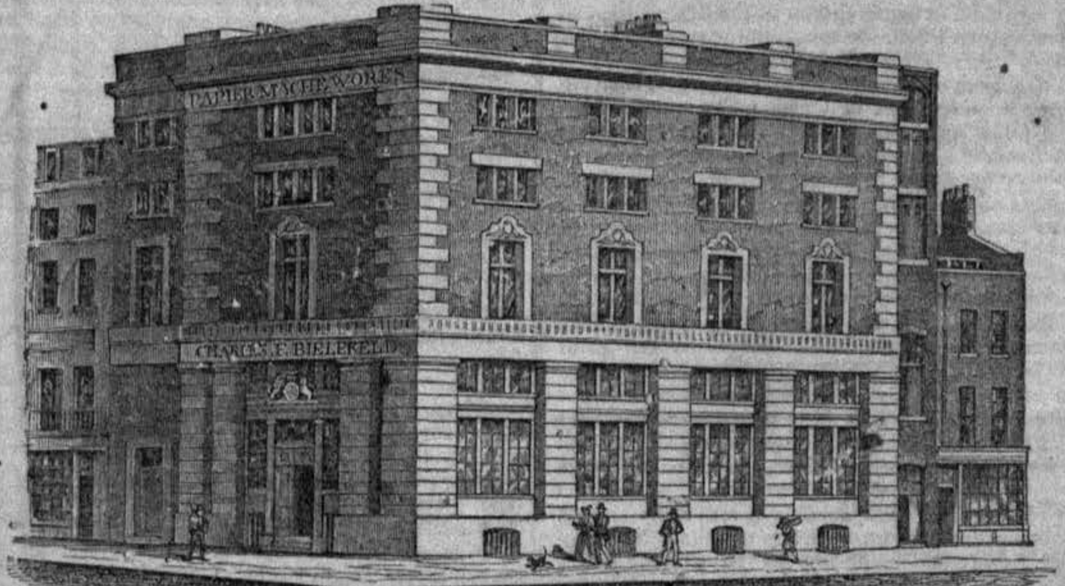
† This is the price of coal in Egypt.

BIELEFELD'S PAPIER MACHÉ WORKS.



BIELEFELD'S PAPIER MACHE WORKS.

A no less singular than conspicuous object, the building lately erected in Wellington Street, North, can hardly fail to attract notice, yet at the same time is likely to puzzle the architectural critic. It has already been spoken of both in the Companion to the Almanac, and in an article on London Shops and Gin Palaces, in the December Number of Fraser's Magazine; nor do we see reason to dissent greatly from the opinions there expressed. The defects of the design is that there is very little sort of agreement between the upper and the lower portion of the building, either as to style, character or material. While the latter is exceedingly plain and sober, the other is fanciful—not to say freakish in the dressings given to the first floor windows, which, nevertheless, do not possess the degree of richness, which would reconcile the eye to what, it must be acknowledged, is *outré* in manner, and which therefore required to be treated not with coldness, nor even sobriety.

We do not object to an intermixture of stone and red brick; on the contrary, we are of opinion that it might frequently be rendered productive of considerable effect; but then we should like to see the two materials combined throughout, from the ground upwards, and not, as is here the case, have a building look as if begun and carried up to a certain height in stone-work, and then completed in brick with only stone dressings. Again, the piers below look narrow and weak compared with those between the windows of the first floor;—a fault that might have been obviated by arching the openings between them, and making the entresol windows in the heads of the arches. This would also have diminished the formality now occasioned by the numerous horizontal lines of those windows and openings, and unnecessarily increased by those of the horizontal rustic joints.

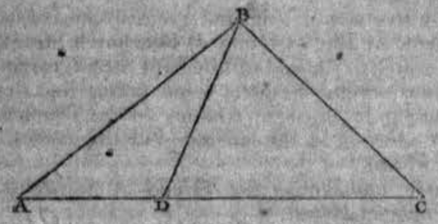
In one respect, indeed, the whole possesses a certain merit, because there is hardly a possibility of mistaking what the building is intended for. Its aspect at once announces it to consist not only of a shop below but a manufactory in the upper stories. It likewise contains spacious show-rooms, relative to which and their contents we shall probably be able ere long to give a more detailed account. The building stands at the corner of Wellington and Exeter Streets, the narrower front or end, being towards the former, the longer one towards the latter; but in regard to this some liberty has been taken in the cut, for though the whole of the South side of the building is shown, not more than the first two windows from the corner of Wellington Street would be visible in the direction here chosen, owing to the narrowness of the other street.

ON THE TESTING OF SURVEYS BY CALCULATING THE LINES OF CONSTRUCTION.

By S. Hughes, C.E.

In transferring to paper the measured lines of a large survey, it is always considered by the surveyor a matter of great satisfaction if the lines prove or fit in to each other as it is called.

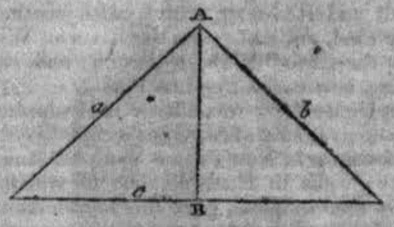
That the meaning of this term may be understood by those who are not conversant with the practice of surveying, suppose three lines have been measured in the form of a triangle, A, B, C, and a fourth line B, D has been measured from one of the angular points to D in the opposite side. It is evident that the three sides of the triangle being given, the length of B D is determined, and ought on the ground to measure neither more nor less than the distance in a direct line from B to D.



Now, if on laying down the above diagram on paper it be found that the distance between B and D either exceeds, or is less than that measured on the ground, the presumption is that an error has been committed, and the work should forthwith be examined in order to discover it. B D is called a proof line, and the above example is given to illustrate the nature of these lines.

The object of this paper is to investigate a few simple formulæ for determining the lengths of proof lines by calculation, in order to save the trouble of laying down at an inconvenient time the main lines of extensive surveys, and to guard against the danger of error in laying down the lines on paper.

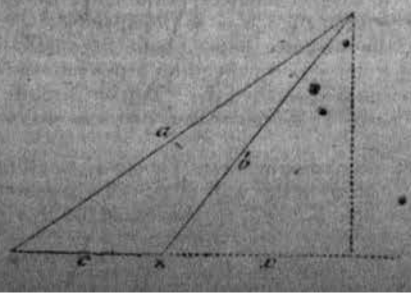
Prob. 1st.—Let a, b, c, be the three given sides of a triangle, it is required to determine the perpendicular A B from the vertex to the opposite side c, and also the segments into which the side is divided by such perpendicular.



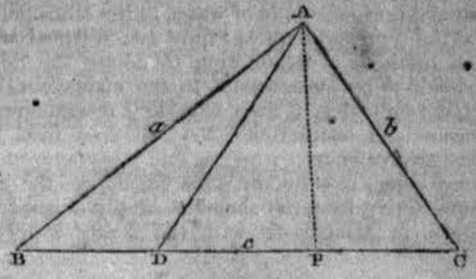
Put $x =$ one of the segments, and we have $a^2-x^2=b^2-(c-x)^2$ or $a^2-x^2=b^2-c^2-x^2+2cx$ add x^2, and $a^2=b^2-c^2+2cx$; subtract b^2-c^2 and $a^2-b^2+c^2=2cx$. Divide by 2 c and $\frac{a^2-b^2+c^2}{2c}=x$ or $\frac{a^2-b^2}{2c}+\frac{c}{2}=x$ the greater segment.

Now the difference of two squares is equal to the product of the sum and difference of their roots. Let s and d be the sum and difference of the two sides a and b, then $\frac{c}{2} \pm \frac{sd}{2c}=x$ the greater or less segment, according as the positive or negative sign is used in the formula. The perpendicular A B of course will be $\sqrt{a^2-x^2}$. From the nature of similar triangles it is also $=\frac{xa}{b}$ where x is the lesser segment, and $=\frac{xb}{a}$ where x is the greater segment.

Suppose an obtuse angled triangle, then $a^2-(c+x)^2=b^2-x^2$ or $a^2-c^2-x^2-2cx=b^2-x^2$. Add x^2 and $a^2-c^2-2cx=b^2$. Add $2cx$ and $a^2-c^2=b^2+2cx$. Subtract b^2 and divide by $2c$, then $\frac{a^2-b^2}{2c}-\frac{c}{2}=x$, or substituting as before the sum and difference of a and b we have $\frac{sd}{2c}-\frac{c}{2}=x$, and the perpendicular here will be $\sqrt{b^2-x^2}$.

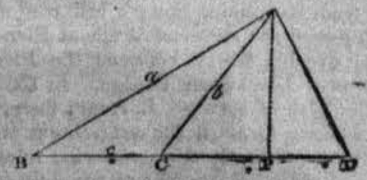


Application I.—Given the three sides a b c of an acute angled triangle, also B D, and consequently D C the segments of the base c, required the length of the proof line A D.

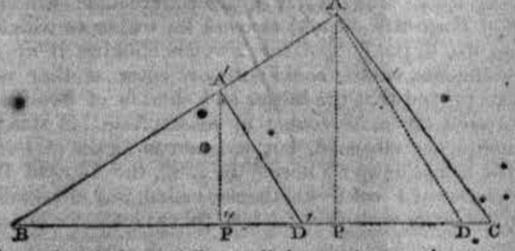


Put B D$=d$ the perpendicular A P as found by the preceding problem$=p$, and, the segment B P also found by the problem$=s$, then $\sqrt{p^2+(s-d)^2}=$A D.

Case II.—Let the triangle be obtuse as A B C, then retaining the same letters as above $\sqrt{p^2+(d-s)^2}=$A D.



Case III.—In the triangle A B C, the three sides are given, also the distances B A′; B D′ required the length of the proof line A′D′.

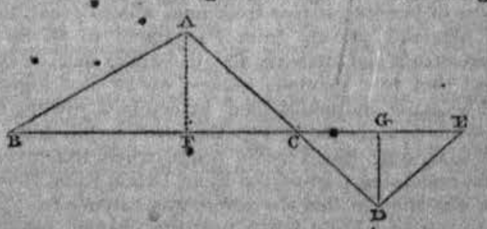


Through the point A draw AD parallel to a A′D′, then B A′ : BA : : BD′ : BD and AD may be found as shewn in case I. Then we have BA : BA′ : : AD : A′D′ the length required.

Or suppose the two sides B A, and BC are given also B A′, B D′ and A′ D′ and the length of the proof line A C be required. Through A′ and A draw A′P′, and A P perpendicular to B C and find the length of A′ P′ by the problem. Then B A′ : B A : : A′P′ : A P find also the length B P, and then $\sqrt{AP^2+(BC-BP)^2}=AC$.

Corollary. By means of the formula in this case may be determined also any proof line measured on the opposite side of the base line to that on which the triangle has been constructed.

Thus let A B C be the triangle of which the sides are given, and of which one of them A C has been continued to D, and its extremity connected by the line D E, with another of the sides B C also produced to E. Draw A F and G D perpendicular to B E, and find the length of A F by the problem, then AC : CD : : AF : DG. The distance CG will then be $=\sqrt{CD^2-DG^2}$. And $ED=\sqrt{GD^2+(BE-BG)^2}$



ON THE SUPPLY OF WATER TO THE METROPOLIS.

Observations on the past and present supply of Water to the Metropolis. By THOMAS WICKSTEED, *Civil Engineer. Read before the Society of Arts, May* 24, 1835.

[This paper which we now present our readers was originally published in the Transactions of the Society of Arts; as we consider its merits entitle it to a more extended circulation, we thought that we could not do a better service to its author and the public, than to take this opportunity of calling attention to it.]

I TAKE the liberty of prefacing the observations I am about to make upon the past and present supply of water to the Metropolis, by stating that it was at the repeated request of my valued friend Mr. Aikin that I was induced to think of attempting to amuse the Society for an hour; and, should I be unsuccessful in the endeavour, I trust credit will be given me for trying, at least, to make a return, however trifling, for the pleasure and instruction I have derived from this Society during the last twelve years.

It will be my object to show the great advantages the inhabitants of this Metropolis derive from the abundant supply of good water which they now have, in comparison with the scanty supply in ancient times.

Supply previous to A.D. 1236, *by Running Brooks.*

The inhabitants of London and its suburbs previously to the year 1236, in the reign of Henry III., were supplied with water not only by the Thames, but also by the following streams, namely, the River of Wells, Old-bourne or Hill-bourne, Wall-brook, and Lang-bourne.

The River of Wells, so called from its being formed by the united streams from several wells in the neighbourhood of the Charter House and Smithfield, flowed to Holborn Bridge, The Old-bourne, or Hill-bourne, so called from its running down a hill ,rose near Holborn Bars, and running west, joined the River of Wells at Holborn Bridge; from thence the united streams flowed between the Fleet and Bridewell into the Thames near Blackfriars Bridge. In 1307, at a Parliament held at Carlisle the 35th of Edward I., Henry Lacy, Earl of Lincoln, complained that whereas formerly the watercourse under the Fleet and Holborn Bridges was sufficiently deep and wide to allow ten or twelve ships at once, loaded with merchandize, to come up to Holborn Bridge, but that in 1199, in the first year of his reign, King John had granted to the Knights Templars ground to erect a mill upon, at Castle Baynard, and the whole of the water in this watercourse (which was afterwards called Turn Mill Brook) to work it; owing to which diversion chiefly, and also to the filth of the Tanners choking it up, and divers other impediments, vessels could not now enter as they were wont; he therefore prayed that the mayor and sheriffs of London might be directed to view the watercourse to substantiate his statements. It was in consequence cleansed, but was never again of the depth or breadth that it had formerly been. In 1502, the 17th of Henry VII., the whole course of Fleet Dyke, then so called, was effectually cleansed so as to allow boats with fish and fuel to navigate as far as Holborn Bridge.

In 1589, in the 31st of Elizabeth's reign, the Common Council of the city granted a fifteenth for the cleansing of this brook, or dyke, and for this purpose the springs on Hampstead Heath were collected into one head and conveyed by means of a channel to Fleet Ditch, to scour it out; but after spending a large sum of money, the work proved a failure, and the banks falling in, the Ditch was choked up more than ever.

In 1668, in Charles the Second's reign, after the fire of London, it was again cleansed, and a handsome canal was made with brick walls and wharfs on each side as far as Holborn Bridge, 2100 feet long, 40 feet wide, and 5 feet deep at a middling tide; but the expense of making this canal, wharfs, &c., (amounting to nearly £28,000,) and the annual cost of keeping it free from mud was so great, that in 1733 the citizens obtained powers from Parliament to fill up the ditch between Fleet Street and Holborn, and to build a market thereon, the act providing that two spacious arches, of 10 feet high and 6 feet wide, should be made and maintained as common sewers, to carry off the waters of the rivulets and sewers that used to fall into the ditch; and in 1760, in George the Third's reign, when Blackfriars Bridge was built, the remaining part of the Fleet Ditch, from Fleet Street to the Thames, was filled in, and the sewer was extended.

It would appear that Fleet Ditch was the channel into which the River of Wells, from the east, and the Old (or Hill) Bourne from the west, flowed, and that the tide flowing up to Holborn Bridge made it navigable so far. That at one time it was called the River of Wells because that was the largest rivulet that ran into it; afterwards Turn Mill Brook, when it was rendered unnavigable by the erection of the Knights Templars' Mill, and the consequent diversion of its waters; afterwards, when the mills were removed, and it was cleansed again and rendered navigable, Fleet Dyke, so called because it was a watercourse allowing many vessels or a *fleet* to pass up;—and afterwards Fleet Ditch, when the unsuccessful attempt to scour it, by means of a channel (which channel is now also called Fleet Ditch,) from the Hampstead springs, had been made. The Old (or Hill) Bourne is now covered over.

Wall-brook derived its name from the circumstance of its being the only running brook that passed through the City walls.

It entered the City near to the east end of Bethlem Hospital, between Bishopsgate and Moorgate, passed on to Lothbury, under St. Mildred's church, Bucklersbury, Wallbrook Street, and Dowgate Hill into the Thames. It is said to have been in ancient times navigable as far as Bucklersbury. It is now arched over, and houses are built over it in many places.

Langbourne-water was a long and great stream of water breaking out of the ground at the east end of Fenchurch Street, and running directly west, nearly to the end of Lombard Street, turned to the south and divided into several rivulets, some falling into the Wall-brook, and others running in separate streams to the Thames at Dowgate; the division, or *sharing*, of the stream gave the name to Sharebourne (or Sherbourne) Lane.

A watercourse intersected the Strand at Salisbury Street, and another near Somerset House.

Supply previous to A.D. 1236 *by Springs.*

Besides these running streams there were a great many wells and pools, namely, Holywell, in Shoreditch; Clement's Well, in St. Clement's Inn in the Strand; Clerks' Well, near Clerkenwell Church, so called from the parish clerks of the City of London, who used formerly to meet there for the purpose of representing certain parts of the Scriptures in a theatrical manner. "These wells," says Fitz Stephen, who was in the service of the famous Thomas à Becket, and wrote a life of that celebrated prelate, "may be esteemed the principal, as being much the best frequented, both by scholars from the schools, and the youth of the City, when in a summer's evening they were disposed to take an airing." Near to Clerks' Well was Skinners' Well, where plays were in ancient times performed.

More eastward, towards the Charter House, were Fagges-well, Tods-well, Loders-well and Red-well, which, with another in Smithfield, called the Horse Pool, united to form the River of Wells.

"Dame-Annis-the-Clear" Well, in Hoxton; and, somewhat west of this, Perilous Pool, now called Peerless Pool.

Without Cripplegate there was a large pool supplied by Crowder's Well, on the north-west side of St. Giles's churchyard.

There was a fountain in New Palace Yard, Westminster.

There were two wells in Shadwell, one of which, a fine and clear spring near to St. Paul's church, gave this suburb its name.

Besides those herein enumerated there were many smaller ones, the situation of which may still be discovered by the names of the streets and alleys or places in their neighbourhood, such as Monks' Well, Bride Well, formerly called Bridget's Well, &c.

London supplied by Conduits subsequently to 1236.

Stow says, "The said River of Wells, the running water of Wall-brook, the bournes afore named, and others the fresh waters that were in and about this City, being in process of time, by encroachment for buildings and otherwise, utterly decayed, and the number of citizens mightily increased, they were forced to seek sweet waters abroad, whereof some" *springs*, "at the request of King Henry the Third in the 21st year of his reign, were, for the profit of the City and good of the whole Realme thither repairing, granted to the citizens and their successors by one Gilbert de Sanford, with liberty to convey water from the towne of Teiborne by pipes of lead into their City." The Tybourne rivulet ran though Tothill Fields to Scholars' Pond, and thence into the Thames; it is now a common sewer. The grant was made in 1236; the work was commenced in 1285: the waters from Tybourne were conveyed by a six-inch leaden pipe to Charing Cross, and from thence to several conduits in the City, the first and greatest of which was erected at the Cross in Cheapside, at the end of Wood Street, in 1285, the distance being about three miles and a half, and for the *first time* water was conveyed by pipes into the City.

In 1401 the prison-house called the "Tun on Cornhill, was converted into a cistern for the Tybourne water, and was afterwards called the Conduit on Cornhill.

In 1423 water was brought from Tybourne to Billingsgate, Paul's Wharf, and to a cistern in the wall of St. Giles's church, Cripplegate.

In 1430 water was brought to the Standard in Cheapside, near Honey Lane.

In 1432 water was conveyed to the gaols of Newgate and Ludgate.

In 1438 water was brought from Tybourne to conduits in Fleet Street and Aldermanbury, and from Highbury to a conduit opposite Cripplegate church.

In 1439 the Abbot of Westminster granted the City one head of water, containing about 800 square yards, or the sixth of an acre, together with all its springs in the manor of Paddington, *provided* the intended work did not *draw* the water from the ancient wells in the manor of Hida; showing by this proviso that four hundred years back it was discovered that any great draught from one well would be likely to leave the other neighbouring wells dry. This grant was confirmed by Henry the Sixth in 1441; and other advantages were granted by a writ of Privy Council, to enable the citizens to bring water by means of leaden pipes under the ground for "above three miles" to a conduit in Cheapside, which was erected in place of the old one at the Cross, which Cross was also re-edified at the same time; and this conduit was used as a reservoir for the supply of other conduits. The water was conveyed from the springs to cisterns at Tybourne, from thence to Charing Cross, and thence to the City.

In 1443 a new conduit was erected near St. Paul's Gate, at the upper end of Cheapside.

In the Old Bailey, a little lower than the Sessions House, was a large cistern with divers cocks, which received the waste water from the prison of Ludgate, for the use of the neighbouring inhabitants.

In 1471 a fresh supply of water was brought by leaden pipes from Tybourne to a conduit erected in Fleet Street, at the end of Shoe Lane, and to other conduits, for the benefit of the people; viz. "for the poor to drink, the rich to dress their meat."

In 1478 a cistern was added to this conduit to hold the waste water, and another at Fleet Bridge.

In 1491 a conduit was erected in Grasse (or Gracechurch) Street.

In 1498 a conduit was erected at Oldbourne Cross, and was again new made in 1577 by William Lamb, citizen, who having drawn together several springs of water into a head at the upper end of Red Lion Street, which was called Lamb's Conduit, conveyed the same to a conduit on Snow Hill, by a leaden pipe 2000 yards long.

In 1509 a stone conduit was erected in the Stocks Market which stood at the north corner of Wallbrook.

About the year 1513 a conduit was erected in Bishopsgate Street.

About the year 1528 a conduit was erected at London Wall.

In 1535 water was brought from Hackney to a conduit erected in Aldgate.

In 1543, notwithstanding the vast expense the citizens had been at in bringing water to, and erecting conduits in, the City, the supply was very inefficient; and an Act was passed in the 31st of Henry VIII. empowering them to bring water from Hampstead Heath, St. Mary le Bon Hackney, and Muswell Hill, upon their compensating the owners of land for damage done by digging or otherwise.

In 1546 water was conveyed in great abundance from divers springs lying between Hoxton and Islington to a handsome conduit erected at the west end of St. Margaret's church, Lothbury.

The Charter House was supplied from White Conduit Fields; Christ's Hospital, from the Devil's Conduit, north-east of Brunswick Square.

Stow mentions amongst the remarkables in the City of London a well at Aldgate curbed with stone of a great depth, and rising into a house two stories from the ground, which is peculiar, "for I have not seen the like in all this City to be raised so high."

There were other conduits of less note than those now enumerated, and wells with buckets or pumps in Threadneedle Street, Leadenhall Street, &c.

Sir John Evelyn writes that about the accession of Queen Elizabeth, in 1558, the waters of Dame-Annis-the-Clear Spring at Hoxton were carted to the breweries in London, at an expense of 800*l*. per annum; and about the same time wells were dug and pumps erected in every corner of the City and suburbs.

Water raised from the Thames by Machinery.

In 1568 a conduit was erected near the top of Dowgate Hill, which was supplied with Thames water by means of a ginn, or machine for raising water, fixed near the river,—most probably what is termed a horse-wheel.

This appears to have been the first machine used in London for raising water for the supply of the public to a higher level than could be done by the common pump.

Thus it appears that London was supplied, first, by running brooks and springs, and secondly, when these failed, by water brought from a distance through leaden pipes, the sources being at a sufficient elevation to allow the water to run into the conduits. In a few instances the waste water from these conduits ran into cisterns adjacent to them, for common or public use; but water was of too much value at that time to allow this to be done generally, and in cases of fire the supply was miserably deficient, which, together with the circumstance of timber being the common material used in the buildings, accounts for the number of destructive fires in ancient times.

Although bringing water by means of pipes from distant sources was a great improvement, so far as respected an increased quantity; nevertheless, the inconvenience and expense of carrying it from the conduits to each house still existed, and it was not until the erection of the London Bridge Water-works, in 1582, that this difficulty was overcome, when the principle of conveying water into dwelling-houses by means of small lead-pipes was adopted; this, the greatest improvement in the mode of supplying water, by substituting the power of machinery for human drudgery, has not been surpassed, and is the plan now used, two centuries and a half after its first introduction; improvements have been made in the practice of it,—the principle remains unaltered.

London Bridge Water-works.

In 1581, or 1582, Peter Maurice, a Dutchman, obtained a lease of the City of the first arch of London Bridge, on the North side, and erected a water-wheel, to be worked by the tide, and a set of force pumps to raise Thames water for the supply of the neighbourhood. The water was raised to the top of a wooden building 120 feet high, and passed from thence through pipes to supply the dwelling-houses in Thames Street, New Fish Street Hill, and Gracechurch Street, as far as a Standard on Cornhill, which was erected in the middle of the street where the four ways meet. The water which was to spare, after supplying the beforenamed streets, flowed from the Standard through four pipes branching to Bishopsgate, Aldgate, the Bridge, and Wallbrook, which supplied the dwelling-houses in the neighbourhood, and cleansed the gutters in these streets. The site of the Standard was supposed to be the highest ground in the City. The quantity of water raised was equal to about 3,170,000 imperial barrels per annum, or an average quantity of 216 gallons per minute, or about ⅞ths per cent. of the quantity raised by the water-works for the supply of the Metropolis at present. There were 16 pumps worked by this wheel, each 7 inches diameter and 30 inches stroke. Mr. Smeaton ascertained from registers that the pumps made 3025 strokes per tide; and, as there are 708 tides per annum, (allowing one-fifth for loss through the valves, according to Dr. Desagulier's statements,) the quantity raised may be calculated. Improvements, however, had been made before the above particulars of the pumps were published, and therefore the quantity given will be the extreme probable quantity raised in 1582.

In 1583 or 1584 machinery was fixed in the second arch.

Improvements were made and the works continued in Maurice's family until 1701, when they were sold, (after an engagement had been made with the City for a lease of the fourth arch,) to Richard Soams, citizen and goldsmith, for 36,000*l*. Soams formed a company, and divided the property into 300 shares of 500*l*. each. In 1761 machinery was erected in the third arch; in 1767 machinery was erected in the fifth arch, and also in the second arch from the Surrey side for the supply of the Borough. The large wheel erected in the fifth arch by Mr. Smeaton was added in consequence of the reduction in the fall of water occasioned by enlarging the water-way under the bridge when two arches were thrown into one. And about this time an atmospheric engine was erected of ten horses' power to assist the wheels at neap tides, and as a safeguard in case of fire happening in the City at the turn of the tide, when the wheels, of course, could not work.

In consequence of the City being obliged to pen up the water to work the wheels, according to an Act passed in 1756, in the 29th of George II., the blocking up of the arches became such a nuisance to the navigation of the Thames, that an Act was obtained in 1822, the 3rd of George IV., for the removal of the London Bridge Water-works, and they were removed accordingly, and the district was supplied by other companies, chiefly by the New River. At the time of the destruction of these works the number of tenants was 10,417, and the quantity of water raised by them was equal to 39,484,000 barrels per annum, or 2704 gallons per minute; showing an increase equal to twelve times the quantity first raised in 1582 by Peter Maurice.

In 1583 two conduits for Thames water were erected near to Old Fish Street Hill.

In 1594, for the better supply of the City, Bevis Bulmar erected a large horse-engine and four pumps at Broken Wharf, to raise Thames water for the inhabitants of Cheapside, St. Paul's Churchyard, Fleet Street, &c., which, Maitland says, was removed previous to the date of his work, 1756, on account of other companies being able to supply water at a cheaper rate.

New River Head Water-works.

The greatest and most splendid work that was ever undertaken for the supply of a modern city with water was commenced in James the First's reign.

In 1605, the 3rd of James the First, the supply of water was found to be inadequate to the wants of an increased population; and as at that time the discovery of the steam-engine had not been made, it was necessary to seek abroad for more powerful springs of water than had hitherto been discovered, and at a sufficient elevation to allow the water to run to London: these were met with in the neighbourhood of Hertford, above twenty miles north of London, and the citizens conceived the vast plan of bringing these springs by means of a channel to Islington, and for that purpose obtained an Act of Parliament, empowering them to bring a stream of water from the springs of Chadwell and Amwell in the county of Hertford, between the towns of Hertford and Ware. By this Act, 3rd of James the First, they were empowered to make a "trench, channel, cut, or river"; the width of the ground to be purchased, being limited to 10 feet; and as these springs were situated in the valley of the river Lee, and, consequently, ran into the said river, they were bound to compensate, not only the owners of property through whose lands the river was to be carried, but also, "all such persons as shall sustain any damage, loss, or hindrance, in their mills standing upon any of the rivers or streams from which the water shall be taken through the said new cut, or river." That this was a proviso of great consequence may be supposed, when at the present day it is stated that one of the springs yields a quantity of water equal to about 3770 imperial gallons per minute, or 54 millions of barrels per annum.

Surveyors were employed by the City to plan the execution of the work; but it was discovered that, as the Act limited the width of the property to be purchased to 10 feet, it would be impossible to convey the waters across the hills and valleys to London: the City therefore applied to Parliament again the following year for power to make tunnels, where necessary, either to be laid in the earth or formed upon arches, and an Act was passed accordingly in the 4th of James the First. Even with these additional powers the course of the river was extremely circuitous, being above 40 miles in length.

Notwithstanding the powers which had been obtained, it appears that the work was not executed until some years after.

In 1608 Sir Hugh Myddleton, citizen and goldsmith, offered at his own charge to carry the Acts of James into execution; and to this great and enterprising man were the inhabitants of the Metropolis indebted for one of the greatest blessings that could be conferred upon any city.

In 1610 the citizens, by an Act of Common Council, made over their powers to Sir Hugh Myddleton; and in 1612 this Act was confirmed by an indenture.

The work, however, appears to have been commenced in 1608, and was completed in 1613.

Maitland states that Mr. Henry Mills, the then engineer to the Company, measured the length of the river accurately in 1723, and found it to be 38⅞ miles and 16 poles, to which it was reduced by the contraction of its sinuosities above two miles.

That there were 215 bridges over it, and that it was carried over two valleys in wooden troughs lined with lead, one at Bush-hill, being 660 feet long and 30 feet high; and the other at Highbury, 462 feet long and 17 feet high. He further says, "As this New River is in some places wafted over hills and vales, so in others, mole-like, it forces its way through subterraneous passages, and arriving at the place unjustly called its Head, in the neighbourhood of Islington 'tis ingulfed by 58 main pipes of bores of 7 inches; whereby 'tis conveyed *into the several streets, lanes, &c. of the City and suburbs of London, to the great convenience and use of the inhabitants, who, by small* leaden pipes of half inch bore, have the water brought into their houses;" the number of tenants amounting in 1756 to 30,000.

It was opened and the water admitted into the basins at the New River Head at Michaelmas, 1613, with great pomp on the day that Sir Thomas Myddleton, brother to Hugh, was elected Lord Mayor.

In 1619 a charter of incoporation was granted by James I. to Sir Hugh Myddleton, citizen and goldsmith, in conjunction with other wealthy citizens, and they were styled "the Governor and Company of the New River brought from Chadwell and Amwell to London." It empowered them to improve the river, to prevent nuisances being committed therein, *under penalty of the King's displeasure*, subject to the laws for the contemners of the King's authority; and, *under the same penalty*, all other parties were prohibited bringing water for the supply of the Cities of London and Westminster, and the Borough of Southwark, without a licence from the Governor and Company of the New River.

The King subscribed towards the undertaking, and was thereby entitled to a moiety of the profits. The work was said to have cost 500,000*l.*: the capital was divided into 72 shares, of which the King had 36; but so poorly did the scheme answer at first, from ignorance of the great advantages that the Metropolis would derive from this splendid work, that Sir Hugh Myddleton, who had spent the whole of his fortune, was ruined, and the proprietors did not for 30 years divide more than 5*l.* per share, or about 1s. 6*d.* per cent. The King, however, who was entitled to a moiety, relinquished his share, reserving only 500*l.* per annum out of it. Although the King's share was in private hands, they took no part in conducting the affairs of the Company.

Previous to the year 1738 the supply from the springs was found to be insufficient, and arrangements were made with the trustees of the river Lee, to enable the New River Company to abstract water from the said river. This was done, first by pipes, and afterwards by a cut and trough into the New River, the dimensions of which were determined by Act of Parliament, passed in 1738, in the 12th year of the reign of George the Second.

This supply, however, was not found to be sufficient, although equal in the aggregate to nearly 17 millions of gallons per diem; or nearly 172 millions of barrels per annum; for in 1822, when the New River Company undertook to supply the London Bridge Water-works districts, it was one of the conditions that they should have a steam-engine to pump from the Thames, in case of failure in the supply of the New River, occasioned by frost or draught; and a 100-horse power engine was accordingly erected at Broken Wharf.

Objections having been made of late years to the water *occasionally* raised by this engine from the Thames, and to the exposed state of the New River, allowing boys to bathe in it, and other nuisances; the Company, upholding the character for enterprise which was bequeathed to them by the great founder of their works, are now applying to Parliament for powers to improve their supply, by relinquishing their station on the banks of the Thames, and in lieu thereof, raising water from the river Lee; and also by fencing in the New River to prevent nuisances being committed therein.

(To be continued.)

BRITISH MUSEUM.—No. V.

(From the Times.)

EGYPTIAN ANTIQUITIES.

THE collection of antiquities in the great saloon of the British Museum, unconnected with the edifices of which they formed part, to the artist are comparatively useless. The monstrosities they represent can neither excite his emulation, nor improve his taste; while to the general visitor they are only regarded as matters of curiosity: he lingers round the mutilated blocks of granite, in vain endeavours to find the meaning of the strange and uncouth figures he sees so innumerably engraved upon them; on turning to the pages of the synopsis, he simply finds the names of Amenothoph, of Rameses, of Ilopth, of Shishak, or of Pthanenoph, and his curiosity remains unsatisfied. A short and more particular description of some of the most important may not be unacceptable.

In the central room a case has lately been opened, in which are two figures, apparently designed to represent a mother and daughter. In beauty of design and execution they are hardly surpassed, if equalled, by any in the collection; they seem to belong neither to the temple nor the tomb, and, whatever they may be called, possess all the appearance of family portraits. *They are sitting on a couch, the legs of* which terminate in lion's paws, and possess more of the Greek than Roman fashion; the height of the elder figure is 5 feet 6 inches, that of the younger 5 feet 2 inches; in the right hand of the mother, which is extended downwards, is the mysterious instrument resembling a key, called the "Iau," which is commonly a mark of the priesthood; the other, which is singular in Egyptian sculpture, is placed upon the daughter's; the faces of both are handsome, that of the youngest might be thought beautiful; the expression of innocence and modesty is finely pourtrayed; the eyes are large, the lips have nothing of the Ethiopian character, the mouth is beautifully shaped, the nose small and delicately formed, and happiness is thrown over the countenance; the figure is slender, the shape of the bosom and shoulders perfect; the hair, which is in a thousand curls, covers the ears, and on the forehead is so arranged as to form a tiara; the dress descends nearly to the ancle, and is intended to represent the finest muslin; around the edges of which is an edging apparently of lace; it is crossed over the breast, and passes through a ring, from which is suspended an amulet in shape like a cross; the feet are bare, the hand and arm perfect. A great likeness is observable in the faces of both the figures, but the lips of the elder are thicker, and the nose and face are altogether more Egyptian; the hair of the latter is also curled, but is not so thick as that of the younger, and the ears are shown, in which are earrings; the dress, which is much shorter, is not so full over the person, but equally fine in the texture; on the feet are sandals, the fastenings of which are minutely executed, and are entirely different from the Greek or Roman style. Some remains of colours are to be observed on the dress, blue and red. There does not appear to be any hieroglyphical inscription on it. Immediately under the columns which separate the saloons are two colossal lions which were given by Lord Prudhoe; they are of red Egyptian granite; on each are two tablets or cartouches, on which the learned have read the names of Amenothoph, the second and third; there are also on them two other tablets, the characters of which have not yet been deciphered; they were brought from Nubia, from Delphi, 500 miles beyond the Cataract. The attitude which is given them, although from the locality whence they were removed evidently betokens their great antiquity, is more true to nature than in the generality of similar figures of Egyptian design; one is lying on the right, and the other on its left side; the right fore leg in one is under the body, all but the paw; the left is stretched across the chest, and the paw, turned flat down, rests on that of the right, the under of which is turned upwards; thus the two paws meet like two hands when brought flat together; the eyes are very long, and have much resemblance to those of Egyptian human statues. There are two small lion sphinxes which much resemble these; they were found by Captain Caviglia when he uncovered the sphinx of the Pyramids, in a small temple, placed between its legs; they are of soft calcareous stone, and have been painted red; their length is about 50 inches; one has a head in the style of the sphinx, and on a plinth are some figures, which are no part of the original design, they are not hieroglyphics. Of the other, the lower part of the face is gone; this has also a low head-dress, and a mane carved in lines down the breast, and what is singular, neither of them possesses much of the Egyptian character, though found in such a situation. No. 11 is the figure of a hawkheaded sphinx, which was found by Belzoni at Ipsamboul. The ram's head in this room, which formed the head of a colossal sphinx, was taken from the avenue at Carnac, and is of soft calcareous stone; the face is 3 feet 6 inches in length, and the horn in the curve 4 feet 11 inches, the tip of which is broken off; on the top of the head is an oblong hole, 4½ inches by 4 deep. From the spirit shown in the sculpture of this head, as also in those of the lions, it is to be seen that the Egyptians excelled far more in their delineation of animals than of the human form; that hardness and inanimation, which is the characteristic of the latter, is not to be complained of in the other. What was the origin of the sphinx, and they are found in Europe, Asia, and Africa, what mystery was hidden in so strange a shape, and still wrapped in obscurity, the general opinion of antiquaries, that a lion's head, united to a woman's body, was to denote the rise of the Nile, when the sun is in the signs of Leo and Virgo, will not suit those with a male head or a ram's head. Winkleman thinks the Androsphinx typifies the male and female principles of worship united in one form, and it is so found in India; the Greek sphinx was a female and a lion; the Egyptian and Jewish, a lion with a man's head; in Arracan, it is a female; in Java, half a woman and half an elephant; and in India the fourth incarnation of Vishnu is a man lion. There are in this room two obelisks of black marble; they are the only ones in the Museum; the one on the right as you enter is that mentioned by Niebur in his travels; it has been broken into two pieces; they are now together; the lower part, which is perfect, is about 8 feet in height; it was found fixed into the side of a doorway of a house in Cairo, and the broken part served for a sill; the north side has a cartouche under the usual symbol of the goose and disc, and another perfect, supposed to contain the name; they are repeated on the opposite side, and nowhere else; the hieroglyphics on the north and south sides are the same; those on the east and west are different, but resemble each other; the first are much better executed than the other; the bird is perhaps one of the best specimens of sculpture found in Egypt; the arch on which it is chisseled out is rounded with great skill; the shadow thrown by the edges formed by the erasion in the stone, added to the shadow cast from the rounded part on the deep incision, gives a fine relief to the lighter and higher parts; the feathers of the wing are also beautifully raised, and the eye is well delineated. The one opposite, which is about the same size, is not so well executed; it has the same cartouche cut on the four sides; the hieroglyphics are the same on both of these obelisks, but differently placed; the sistrum is shown on both, and what is supposed to be the proper name on the Alexandrian sarcophagus, as also the prenomen, is the same which appears on these. It was the opinion of Denon that obelisks and gateways which are often found insulated before the temples were votive offerings to the collective gods. The colossal head on which is the mitre, called the Teshr, was found by Belzoni at Carnac, east of the Nile; it is of red granite, and is highly polished, and of much larger dimensions than the one opposite, called the lesser Memnon; the face has much more of the Ethiopian character, and does not possess the softness which is seen in the other, and is evidently of an earlier date; the height from the top of the mitred crown is 10 feet; the beard-case and left ear only are destroyed; the colossal arm lying near it belonged to this statue, and from its being straight and in a falling position shows it must have been an upright one; in the hand are the remains of a staff or sceptre. The cap is fastened with bands under the chin. From the position of the arm and head its height must have been at least 26 feet, and it is observable in this, as in almost all the Egyptian figures, that the ear is placed too high on the head.

The colossal figure marked 21 was discovered in the ruins of a temple behind the Colossi at Thebes, between the Memnonium and Medinet Abu; it is an exact model of the great figure of Memnon at Thebes, the exact height of which is 70 feet; it is in a sitting position, and has a close-fitting cap on the head, on the front of which is the aspic serpent. The beard and lower part of the chin are broken. The stone is a breschia, and looks black, but it is a dark gray, and has bright yellow particles in it, and is the only statue of that kind of stone in the collection. The hair is curiously gathered behind, and, from a number of radii collected in a convex form, is gathered into a long tail; it has a nether garment, of corduroy appearance, attached to a belt round the waist, and overlaps in parts on the thighs, on which are extended the hands, which are badly executed. At the back of the throne is a square column, and the cartouches there inscribed contain, as we are told, the name of Amenothoph or Memnon, being the same as those on the Theban colossus.

A colossal head of Jupiter Ammon, of white stone, marked 30, is finely executed; it was in the collection of Mr. Salt, found by Belzoni, at Carnac. Part of the face is destroyed, but as it remains, the difference of expression observed on viewing it is remarkable. In the front it possesses the general character of Egyptian composure; on the northern side it is grave and severe, and on the eastern it has the same smile as is seen on the face of the lesser Memnon.

Another head of equal size, on the left of the room as you enter, is the only Egyptian one in the Museum on which the beard is seen; in all the others it is placed in a sort of case, but here it is sculptured on the stone; flat lappets descend on each side of the head, the breadth of which are of the same size as the fringy beard. The stone of which it is formed is a brownish breschia, peculiarly difficult to cut. The great sarcophagus on the left, near the entrance, given by Colonel Vyse in 1839, is of red breschia, and is well deserving inspection. The hieroglyphics are highly finished; they are not so numerous as those on the tomb of Alexander, or the one opposite called the Lovers' Fountain, but of better execution. It has a lid of circular form, which fits with a ledge; there is a band of hieroglyphics on each side: in each band are 12 figures 4 inches in length, all different, and divided from each other by a tablet of inscriptions; 11 of these figures are faced by one at the end, a band of hieroglyphics reaches halfway along the cover, another crosses this, and then there are 6 more, 3 of which are but half the length, to give room for 3 figures of mummies, of which there was probably 3 within the monument. Above this there is a face deeply cut, the features of which are completely of the negro character. It has the usual "oskh" or cunicular tippet worn round the neck. The length is 9 feet, and the breadth 3 and a half. The colour of the stone forming the top is much lighter than the lower part of the sarcophagus. No. 10, which is supposed to have been the tomb of Alexander, consists of a single block of stone ten feet in length, four in height, and about five in breadth. It is a particular kind of prismatic conglomerite, resembling that which is under the second porphyry formation, and is entirely covered with hieroglyphics in lines. On his death, we are told by Curtius, his body was enshrined in golden chasework, over which was put a purple vestment, and then his armour: on his arrival at Alexandria it was there deposited, but whether in this sarcophagus or not has been matter of dispute. He was worshipped as the thirteenth god of the Egyptians; three centuries after his death his body was seen by Augustus. Tacitus says the tomb was again opened by Caligula, and the breastplate taken out and worn by him. When the body was removed is unknown, but the Mahometans had always revered and concealed this sarcoghagus from the Christians till seized on by the French.

The engraved tablet of black basalt, called "the Rosetta-stone," the "*crux antiquariorum,*" contains three inscriptions—one in hieroglyphics, one in the ancient spoken or enchorial language of Egypt, and the other in Greek. The learned have read, that they record the services which Ptolemy V. had rendered to his country, and that they were engraved by the order of the priesthood assembled at Memphis, for the purpose of investing him with the regal powers. Till the discovery of this stone, which was found by the French in digging the foundation of Fort St. Julian at Rosetta, notwithstanding the labours of Kircher and others, the innumerable inscriptions and the monstrosities which are found engraved or painted on every relict of Egyptian antiquity remained matter of doubt and wonder, and were veiled in the darkness of conjecture. The arrival of this stone was therefore hailed with equal joy by the learned, as would the recovery of the key of an unpickable Bramah by its unhappy loser. Upon the engraving of this block a wondrous system has been raised, which, if it is perfected, is destined to enlighten us in "all the wisdom of the Egyptians," and lay open to the inquiring mind of the 19th century all the knowledge which is thought to be contained in those inscriptions, the amount of which, taken collectively, would fill 10,000 volumes. Some short account of the deciphering system pursued may not, in connexion with the whole of the Egyptian monuments, be unacceptable.

The first author who mentions the writings of the Egyptians says, they had two kinds of characters, one called sacred, and the other popular; but he does not say that they had any affinity with each other. Diodorus Siculus mentions the same, with the addition that the first were peculiar to the priests, and the other was taught to all. Concise as this is, it is all the information these authors give. The next is the celebrated passage in the works of Clemens Alexandrinus, in which the different kinds of writing are given with considerable precision. He says there were three kinds—the Epistolographic, the Hieratic or sacred, and thirdly, the most complete of all, the Hieroglyphic, which he tells us is expressed by means of the first or initial element of words, that is, by reference to the initial sounds of words which denote these objects in the spoken language of the country. Upon this scanty foundation the most extraordinary theories have been built; the six folios of Kircher, according to his interpretation of the hieroglyphical inscriptions, which succeeded equally whether he began at the beginning, the middle, or at the end of the text, are found to be filled with the cabalistic science and strange fancies of a refined system of Dæmonism. The Abbe Pluche has discovered that they are all astronomical, or expressive of the doctrines connected with the science of astronomy, and the division of time in the calendar; and the author of a work entitled *de L'Etude des Hieroglyphiques*, published at Paris in 1812, found in the inscription on the temple at Dendera a translation of the 100th Psalm of David, a foreign language, which most likely the inhabitants of the country never understood. Count Palin has persuaded himself that the hymns of David are but Hebrew translations of the consecrated rolls of Egyptian papyrus. All these fantastic reveries have, however, given way to the system of Dr. Young, the invention of which has been disputed by M. Champollion; he followed the idea of Warburton, *that the hieroglyphic or sacred character*, was not so called because peculiarly appropriated to sacred subjects, but that they constituted a written language applicable to all the purposes of life, that they were not used to represent things or ideas, but that they represented *sounds or words, that they* were alphabetical, and that they exhibited things or objects, the common names of which in the spoken language began with the sounds it was wished to express. To make this more intelligible we give the following example:—If there was no *other manner of writing than by* pictures, or symbols, and the spoken language of England the same as *it now is, and it was required to write the* name of James, this name being a mere sound could not be intimated to any one by a picture or symbol; but if it was understood that the key of this name was to be obtained by reference to a series of pictures of familiar objects, the names of which in the spoken language begun with the sounds which were successively to be expressed, and which when taken together in that order made up the name, thus, for the sound now expressed by the letter J the figure of a jug or jar was set down, for an A an ape or an acorn, for an M a man or a mouse, and for an S a spear or a spur; the name of James would then by a sort of symbolic acrostic be intimated to all who read the figures in the spoken language. This is the basis of the principle of Dr. Young, De Lacy, and Champollion, and the literati have proceeded upon this to decipher the Egyptian hieroglyphics. To what extent they have succeeded yet remains a matter of doubt; but in consequence the visitor to the Museum, when passing on from viewing the dilapidated remains of Egyptian sculpture in the lower saloon, regretting his ignorance of the strange writing and figures on all of them engraved, is agreeably surprised when he enters the gallery above to recover his mistake; here he finds all is known and deciphered; he reads these are the remains of Pefaakons surnamed Onkhouomofie, auditor of the Royal palace; that the next is Panamoun, priest of Ammon; that a lady lying near is Iatsbabem, daughter of Petkons, porter of Amoun, and born of Iamaak, lady of the house; he is startled at the immorality; that another is Penamaum, an incense-bearer, son of Ohnofie, son of Hor and of Baeurow, daughter of Saklous; and he supposes that want of space has alone prevented a full account of their lives and actions, easily to be read on their inscriptions, from being given in the synopsis; but he will find on inquiry that serious objections may be raised even to the validity of the names attached, much more to any particular account of their offices or actions.

All the modern expounders of hieroglyphics have raised the structure of their expositions on the trilingual inscription seen on this Rosetta stone, and principally depend upon it. Dr. Young, the most celebrated of them all, did not begin his researches till after its discovery; he knew nothing of it, but from the French account, and it is upon that account alone that the genuineness of the inscription depends; it is true that some other stones with triplicate inscriptions have been found, but that would be the necessary consequence of the first being made: the size and nature of all of them evidently show that they were not in ancient times kept concealed, and if they are so ancient and genuine as we are to believe, why did not the Roman writers go at once to these inscriptions scattered about the country to interpret that which they all regret was lost? It may be said that it would be almost impossible to have forged the inscriptions on this stone, it would only have made the last or Greek one, and when we look at the manufacture of ancient Etruscan vases and cameos in Staffordshire, the tricks of the Parian marbles, the manuscripts of Shakspeare, the copies of Raphael, and read the astounding tale that Professor Houtton, of the Medico Botanical Society, produced a bulbous root found in the cranium of a mummy, in a situation in which it had probably lain 2,000 years, that it germinated when exposed to the atmosphere, though when discovered in a state of perfect dryness, and on being placed in the ground it grew with readiness and vigour, and also know that mummies are manufactured every day, and consider the authority on which it rests, the impossibility of this monument not being genuine is very difficult to believe. In Pompeii articles are constantly buried to be found when wanted, and it has always been observed that the higher the rank of the visitor to those remains the more successful is he in his antiquarian search. There may be 100 Rosetta stones discovered, but the more that are found the more difficult it is to account for the ignorance of Clemens and others on the subject. The plan both of Champollion and Young, of making many phonetic signs for one letter, will make them speak whatever the expositor desires, and proves that arbitrary figures which are not hieroglyphics may be made to give any meaning he may please. If this inscription on the Rosetta stone is genuine, why did not Clemens, who lived at Alexandria, go to it to remove his ignorance, which the passage in his work on the subject proves, and why did not Strabo also? They both could have read the Greek, which the best Scotus *can now hardly* understand. But what more clearly proves that the meaning of the hieroglyphics was unknown in the Roman times, *is the fact, that one of the* first emperors offered a reward for the deciphering of those on an obelisk he brought to Rome. The ignorance of *Diodorus, Strabo*, and Clemens is a pretty good proof that the inscriptions found on the trilingual stones are *modern fabrications, else why are so few found*, and none on the temples and statues themselves? Whether the French sçavans were the inventors and *fabricators* is certainly difficult to determine, but that is far more likely than that the authors we have mentioned, and *the Roman emperors*, should have been ignorant whether hieroglyphics were in use in their time or not. *Neither Strabo nor Diodorus says that* the hieroglyphics were known in their day; yet if they had been, why have not those authors quoted them in their histories of the Egyptian mythology? It is more than probable that these inscriptions were *never intended to be* read but by those who had the tradition of their meanings, and that the priests having been massacred in the Persian conquest by Cambyses, that tradition was lost. The same would have been the case with the traditionary learning of the Mexicans had not the Spaniards preserved it. Both Dr. Young and Champollion have found by their process the names of Roman emperors on the same monument with those of the Pharaohs and Ptolomies, in situations where they could not have been erased. How can they account for this? If the names of Ptolemy and Cleopatra, and the Romans, are to be found on the buildings and obelisks written in hieroglyphics, of course they could not have been lost in the time of Strabo and Clemens, yet any one who attentively considers the passage in his work, and that passage is the foundation of all modern explication, must come to the conclusion that the obscurity in which he has enwrapped it was purposely done to conceal his ignorance of that which he pretended to describe.

To the plan of Dr. Young and other learned expositors of reading the hieroglyphics by applying the first letters of Egyptian words of the common vernacular tongue now in use—viz., the Coptic—it would be satisfactory to imply that it must always have remained the same, or nearly so. It is true, we are told nothing changes in the East; but, notwithstanding, it is impossible not to believe but that tongue, admitted to have always been the spoken language of the country, passing through the crucible of conquest by the Ethiopian, the Shepherd Kings, the Israelites, the Persians, the Greeks, the Romans, and the Saracens, during a period of 3,000 years, must have been so dislocated and altered as to have rendered it impossible to read the symbolic or hieroglyphic language of Sesostris in the Coptic or the oldest Coptic books now extant.

RAILWAY CURVES.

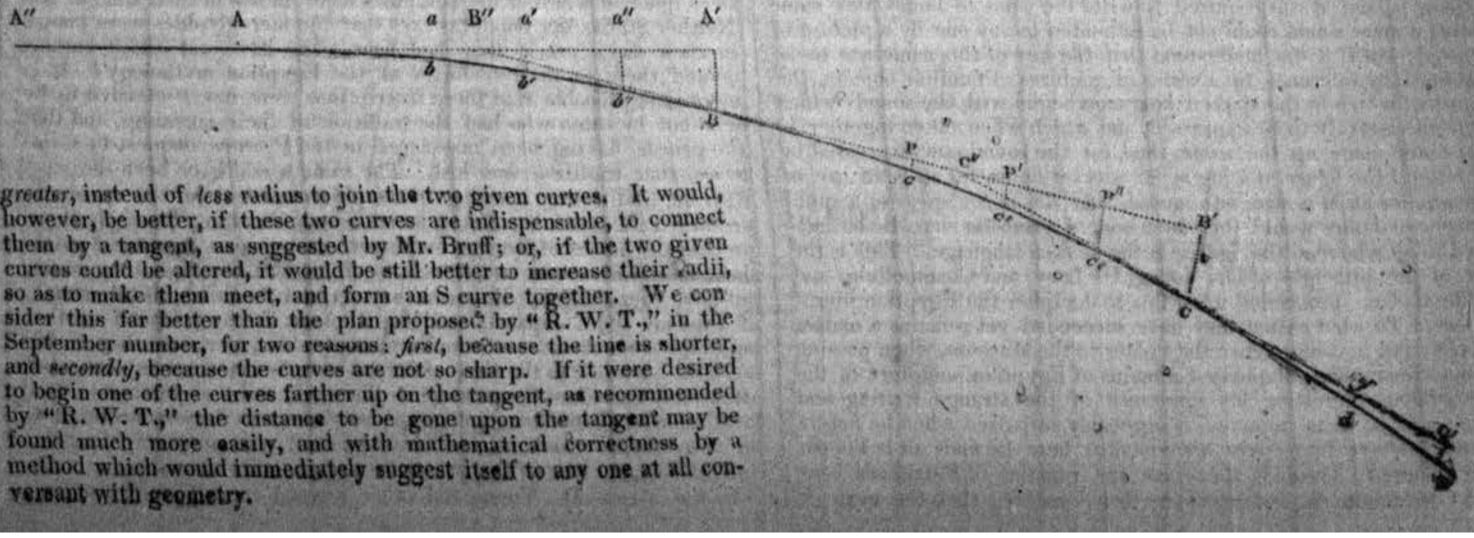
In compliance with the request of several members of the profession, we have carefully perused the communications of our correspondents on the subject of railway curves, and, after a careful examination of the various methods therein proposed, we cannot but concur in their opinion, that the question has not yet been satisfactorily settled. We therefore engaged Mr. Aristides Mornay, a gentleman well known for the accuracy of his calculations, to construct a set of tables to facilitate the execution of a plan which we shall presently explain, after having offered a few remarks on the proposals contained in the above mentioned communications, which were published in the Journal during the past year.

In the January number Mr. Murray, under the signature of "A Sub.," proposes as an improvement upon the system of running directly from a straight line to a curve of 1½, 2, or 2½ miles radius, that a curve of 3, 4 or 5 miles radius for a short distance should be made use of to connect them. He adds that projectiles (where the resistance is equal) assume the parabolic curve, to which the plan he proposes is an approximation.

This observation about projectiles is properly answered in the number for March, by "R. W. T.," who also justly observes that "if the curvature is not equable," which would be the case if Mr. Murray's advice were followed, "some parts of it must be sharper than if the same radius were used all through."

In the April number Mr. Ely denies the correctness of "R. W. T.'s" statement, on the ground that Mr. Murray's object is to "begin curving sooner, and make the radii of portions of the curve *greater*." This objection would only obtain, if the object were, besides beginning with a curve of greater radius, to terminate also with a curve of greater radius, which would join the straight continuation of the line farther on than the single curve of uniform radius originally supposed. This *however was not Mr. Murray's intention, as is evident* from his own diagram and description in the November number. He has assumed *a certain point to be arrived at, without considering that the direction* of the continuation of the railway is also determined before-hand. *These two conditions being given, it is obvious that the junction must* either be effected by means of an uniform curve of a radius deter*mined by the given circumstances, or by commencing the curve sooner* with a longer radius, and terminating with another of shorter radius.

With respect to the queries of "An Assistant Engineer," in the April number, it appears Mr. Bruff has not exactly comprehended the first, or at least has not expressed himself very clearly. If the case is as represented in "An Assistant Engineer's" diagram, the solution of his problem is impossible: it would be necessary to use a curve of *greater*, instead of *less* radius to join the two given curves. It would, however, be better, if these two curves are indispensable, to connect them by a tangent, as suggested by Mr. Bruff; or, if the two given curves could be altered, it would be still better to increase their radii, so as to make them meet, and form an S curve together. We consider this far better than the plan proposed by "R. W. T.," in the September number, for two reasons: *first*, because the line is shorter, and *secondly*, because the curves are not so sharp. If it were desired to begin one of the curves farther up on the tangent, as recommended by "R. W. T.," the distance to be gone upon the tangent may be found much more easily, and with mathematical correctness by a method which would immediately suggest itself to any one at all conversant with geometry.



We now come to the second query, the solution of which is the main object of these remarks: viz. "Which is the most correct mode of setting out railway curves?" Mr. Foster Charlton's method, recommended by Mr. Bruff, and extracted from "Weale's Scientific Advertiser," is correct; but we do not think it practicable, as it is necessary to construct a triangle of which the lengths of the sides are given, which operation must be exceedingly difficult when two of the sides are several chains in length. "B. W. T.'s" method, given in the May number of our journal, is incorrect, and is not sufficiently explained to enable any one to put it in practice.

The mode described by "Surveyor," in our June number is a correct one, and partly the same as that we propose; but the measurement of the angle contained between the two straight lines to be connected is perfectly unnecessary, and he does not appear to have been prepared with a practical mode of laying off the second tangent.

The method described by our correspondent "M." in the July number, as that usually adopted, besides not being mathematically correct, must be attended with much difficulty in practice, on account of the necessity of constructing triangles whose sides are given; but that proposed as a substitute, although perfectly correct, if the work is accurately performed, is nearly, if not quite as difficult of execution as the former.

It only remains for us now to explain the method we propose for setting out railway curves, which we think will be found to be applicable in all cases, and generally easier of execution than any other *correct* plan. The explanation is illustrated by reference to the accompanying diagram.

Let A″ A be the direction of the railway before curving, and A the point at which the curve is to commence. Produce A″ A to A′, making AA′ any convenient length, and at the point A′ erect the perpendicular (A′ B or offset) on the line AA′, which is a tangent to the required curve, and make A′ B (the offset) equal to the length given in the column *o* of the accompanying tables; B will be a point of the curve. In the figure we suppose the radius of the curve to be a quarter of a mile, or 20 chains, and the tangent AA′, 5 chains. The table gives A′ B=63·5 links. From the point A, measure on the tangent AA′ a distance AB″ equal to the length found in the column *t* of the table, which is in the present case 2 chains 54 links, and through the points B″ and B (already found), draw the straight line B″ B B′, making B B′, which is a new tangent to the curve, equal to A A′, or any other convenient length; set off B′C at right angles to B B′, and equal to A′ B if B B′ was taken equal to A A′, otherwise equal to the length given in the column *o* under the length of tangent equal to BB′. C will be another point of the curve, and by proceeding in the same manner we can determine as many points as may be desired. By taking on any one of the tangents, such as A A′, a number of intermediate points, *a*, *a*′, *a*″, so that A*a*, A*a*′, A*a*″ shall be equal to lengths of tangents given in the table, the corresponding offsets, *ab*, *a′b′*, *a″b″*, which are given in the column *o* under the respective lengths of tangents, will serve to determine as many intermediate *points of the curve*, *b*, *b′*, *b″*, *situated between the points* A and B. In the figure we have taken B B′ equal to A A′, or 5 chains, but the next *tangent*, C C′, *for want of room, has been made only* 3 *chains long*, so that the offset C′ D is only 22·6 links, as we find in the column *o* under the *length of tangent* 3 *chains*. The *portions* A*a*, BP and C*y* have been made each 2 chains, for which length of tangent we find the offset =10 links, and the *other distances* P*c*, P′*c*′, P″*c*″, &c. *having been* taken each equal to 1 chain, the tangents are 3 and 4 chains, and the offsets 22·6 and 40·4 links.

TABLE I.—CURVES FROM 5 CHAINS TO 80 CHAINS, OR ONE MILE RADIUS.

Radius of the Curve.	LENGTH OF THE TANGENT IN CHAINS.																			
	½		1		1½		2		2½		3		3½		4		4½		5	
	t	o	t	o	t	o	t	o	t	o	t	o	t	o	t	o	t	o	t	o
Chains.	Links.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.
5	25·1	2·5	50·5	10·1	76·8	23·0	104·4	41·7	134·0	67·0	166·7	100·0	203·2	142·2	250·0	200·0	313·4	282·1	500·0	500·0
6	25·0	2·1	50·4	8·4	76·2	19·1	103·0	34·3	131·0	54·6	160·8	80·4	193·1	112·7	229·2	152·8	270·9	203·1	322·0	268·1
7	..	1·8	50.3	7·2	75·9	16·3	102·2	29·2	129·3	46·2	157·6	67·5	187·6	93·8	219·7	125·5	254·8	163·8	294·4	211·0
8	..	1·6	50·2	6·3	75·7	14·2	101·6	25·4	128·2	40·1	155·7	58·4	184·3	80·6	214·4	107·2	246·3	138·6	280·7	175·4
9	..	1·4	..	5·6	75·6	12·6	101·2	22·5	127·5	35·4	154·4	51·5	182·2	70·8	211·0	93·8	241·2	120·6	275·0	151·7
10	..	1·2	50·1	5·0	75·5	11·3	101·0	20·2	127·0	31·8	153·5	46·1	180·7	63·3	208·7	83·5	237·7	107·0	268·0	134·0
11	..	1·1	..	4·6	75·4	10·3	100·8	18·3	126·6	28·8	152·9	41·7	179·7	57·2	207·1	75·3	235·3	96·3	264·5	120·2
12	..	1·0	..	4·2	75·3	9·5	100·7	16·8	126·4	26·3	152·4	38·1	178·9	52·2	205·9	68·6	233·5	87·6	261·9	109·1
13	..	1·0	..	3·9	75·3	8·7	100·6	15·5	126·2	24·3	152·0	35·1	178·3	48·0	205·0	63·1	232·2	80·4	260·0	100·0
14	..	·9	..	3·6	75·2	8·1	100·5	14·4	126·0	22·5	151·7	32·5	177·8	44·5	204·3	58·4	231·1	74·3	258·5	92·3
15	..	·8	..	3·3	75·2	7·5	100·5	13·4	125·9	21·0	151·5	30·3	177·4	41·4	203·7	54·3	230·3	69·1	257·4	85·8
16	..	·8	..	3·1	75·2	7·1	100·4	12·6	125·8	19·7	151·3	28·4	177·1	38·7	203·2	50·8	229·7	64·6	256·4	80·1
17	..	·7	50·0	2·9	75·1	6·7	100·4	11·8	125·7	18·5	151·2	26·7	176·9	36·4	202·8	47·7	229·1	60·7	255·6	75·2
18	..	·7	..	2·8	75·1	6·3	100·3	11·2	125·6	17·4	151·1	25·2	176·7	34·4	202·5	45·0	228·6	57·2	255·0	70·8
19	..	·7	..	2·6	75·1	5·9	100·3	10·5	125·5	16·5	151·0	23·8	176·5	32·5	202·2	42·6	228·3	54·1	254·5	67·0
20	..	·6	..	2·5	75·1	5·6	100·2	10·0	125·5	15·7	150·9	22·6	176·4	30·9	202·0	40·4	228·0	51·3	254·0	63·5
21	..	·6	..	2·4	75·1	5·4	..	9·5	125·4	14·9	150·8	21·5	176·3	29·4	201·8	38·4	227·7	48·8	253·6	60·4
22	..	·6	..	2·3	75·1	5·1	..	9·1	125·4	14·2	150·7	20·5	176·2	28·0	201·7	36·7	227·5	46·5	253·3	57·6
23	..	·5	..	2·2	75·1	4·9	..	8·7	125·4	13·6	150·6	19·6	176·1	26·8	201·6	35·1	227·2	44·4	253·0	55·0
24	..	·5	..	2·1	75·1	4·7	..	8·3	125·4	13·0	150·6	18·8	176·0	25·7	201·4	33·6	227·0	42·6	252·8	52·7
25	..	·5	..	2·0	75·1	4·5	..	8·0	125·3	12·5	150·5	18·1	175·9	24·6	201·3	32·2	226·8	40·9	252·6	50·5
26	..	·5	..	1·9	75·1	4·3	..	7·7	125·3	12·0	150·5	17·4	175·8	23·7	201·2	31·0	226·7	39·3	252·4	48·5
27	..	·5	..	1·9	75·1	4·2	..	7·4	125·3	11·6	150·5	16·7	175·7	22·8	201·1	29·8	226·6	37·8	252·2	46·7
28	..	·4	..	1·8	75·1	4·0	..	7·2	125·3	11·2	150·5	16·1	175·7	22·0	201·0	28·7	226·5	36·4	252·0	45·0
29	..	·4	..	1·7	75·1	3·9	100·1	6·9	125·2	10·8	150·4	15·5	175·6	21·2	201·0	27·7	226·4	35·1	251·9	43·4
30	..	·4	..	1·7	75·1	3·8	..	6·7	125·2	10·4	150·4	15·0	..	20·5	200·9	26·8	226·3	33·9	251·8	42·0
31	..	·4	..	1·6	75·1	3·6	..	6·5	125·2	10·1	150·4	14·5	..	19·8	200·9	25·9	226·2	32·8	251·7	40·6
32	..	·4	..	1·6	75·1	3·5	..	6·3	125·2	9·8	150·4	14·1	..	19·2	200·8	25·1	226·2	31·8	251·6	39·3
33	..	·4	..	1·5	75·1	3·4	..	6·1	125·2	9·5	150·3	13·7	175·5	18·6	200·8	24·4	226·1	30·8	251·5	38·1
34	..	·4	..	1·5	75·1	3·3	..	5·9	125·2	9·2	150·3	13·3	..	18·1	200·7	23·6	226·0	29·9	251·4	37·0
35	..	·4	..	1·5	75·1	3·2	..	5·7	125·2	8·9	150·3	12·9	..	17·6	200·7	22·9	226·0	29·1	251·3	35·9
36	..	·3	..	1·4	75·0	3·1	..	5·6	125·2	8·6	150·3	12·5	..	17·1	200·6	22·3	225·9	28·3	251·2	34·9
37	..	·3	..	1·4	..	3·0	..	5·4	125·1	8·4	150·2	11·1	175·4	16·6	200·6	21·7	225·8	27·5	251·1	33·9
38	..	·3	..	1·3	..	3·0	..	5·3	..	8·2	..	11·8	..	16·2	200·6	21·1	225·8	26·8	251·1	33·0
39	..	·3	..	1·3	..	2·9	..	5·1	..	8·0	..	11·5	..	15·7	200·5	20·6	225·7	26·1	251·0	32·2
40	..	·3	..	1·3	..	2·8	..	5·0	..	7·8	..	11·3	..	15·3	200·5	20·1	225·7	25·4	251·0	31·4
41	..	·3	..	1·2	..	2·7	..	4·9	..	7·6	..	11·0	175·3	15·0	200·5	19·6	225·7	24·8	250·9	30·6
42	..	·3	..	1·2	..	2·7	..	4·8	..	7·4	..	10·7	..	14·6	200·5	19·1	225·7	24·2	250·9	29·9
43	..	·3	..	1·2	..	2·6	..	4·7	..	7·3	..	10·4	..	14·3	200·4	18·6	225·6	23·6	250·8	29·2
44	..	·3	..	1·1	..	2·6	..	4·6	..	7·1	..	10·2	..	14·0	..	18·2	225·6	23·1	250·8	28·5
45	..	·3	..	1·1	..	2·5	100·0	4·4	..	7·0	..	10·0	..	13·7	..	17·8	225·5	22·6	250·8	27·9
46	..	·3	..	1·1	..	2·4	..	4·3	..	6·8	..	9·8	..	13·4	..	17·4	..	22·1	250·7	27·3
47	..	·3	..	1·1	..	2·4	..	4·2	..	6·7	..	9·6	175·2	13·1	..	17·0	..	21·6	250·7	26·7
48	..	·3	..	1·0	..	2·3	..	4·1	..	6·5	150·1	9·4	..	12·8	200·3	16·7	..	21·2	250·7	26·1
49	..	·3	..	1·0	..	2·3	..	4·1	..	6·4	..	9·2	..	12·5	..	16·3	..	20·8	250·7	25·6
50	..	·3	..	1·0	..	2·2	..	4·0	..	6·3	..	9·0	..	12·2	..	16·0	..	20·4	250·6	25·1
51	..	·2	..	1·0	..	2·2	..	3·9	..	6·1	..	8·8	..	12·0	..	15·7	..	20·0	..	24·6
52	..	·2	..	1·0	..	2·2	..	3·8	..	6·0	..	8·6	..	11·8	..	15·4	225·4	19·6	..	24·1
53	..	·2	..	·9	..	2·1	..	3·8	..	5·9	..	8·5	..	11·5	..	15·1	..	19·2	..	23·6
54	..	·2	..	·9	..	2·1	..	3·7	..	5·8	..	8·3	..	11·3	..	14·8	..	18·8	250·5	23·2
55	..	·2	..	·9	..	2·0	..	3·6	..	5·7	..	8·2	..	11·1	..	14·6	..	18·5	..	22·8
56	..	·2	..	·9	..	2·0	..	3·6	..	5·6	..	8·0	175·1	10·9	200·2	14·3	..	18·2	..	22·4
57	..	·2	..	·9	..	2·0	..	3·5	..	5·5	..	7·9	..	10·7	..	14·0	225·3	17·9	..	22·0
58	..	·2	..	·9	..	1·9	..	3·4	..	5·4	..	7·8	..	10·5	..	13·8	..	17·6	..	21·6
59	..	·2	..	·8	..	1·9	..	3·4	..	5·3	..	7·6	..	10·3	..	13·6	..	17·3	250·4	21·2
60	..	·2	..	·8	..	1·9	..	3·3	..	5·2	..	7·5	..	10·2	..	13·4	..	17·0	..	20·9
61	..	·2	..	·8	..	1·8	..	3·3	..	5·1	..	7·4	..	10·0	..	13·1	..	16·7	..	20·5
62	..	·2	..	·8	..	1·8	..	3·2	..	5·0	..	7·3	..	9·9	..	12·9	..	16·4	..	20·2
63	..	·2	..	·8	..	1·8	..	3·2	..	5·0	..	7·1	..	9·7	..	12·7	..	16·1	..	19·9
64	..	·2	..	·8	..	1·8	..	3·1	..	4·9	..	7·0	..	9·6	..	12·5	..	15·8	..	19·6
65	..	·2	..	·8	..	1·7	..	3·1	..	4·8	..	6·9	..	9·4	..	12·3	..	15·5	..	19·3
66	..	·2	..	·8	..	1·7	..	3·0	125·0	4·7	..	6·8	..	9·3	..	12·1	..	15·3	..	19·0
67	..	·2	..	·7	..	1·7	..	3·0	..	4·7	..	6·7	..	9·1	..	11·9	..	15·1	250·3	18·7
68	..	·2	..	·7	..	1·7	..	2·9	..	4.6	..	6·6	..	9·0	..	11·7	225·2	14·8	..	18·4
69	..	·2	..	·7	..	1·6	..	2·9	..	4.5	..	6·5	..	8·9	..	11·5	..	14·6	..	18·1
70	..	·2	..	·7	..	1·6	..	2·9	..	4.5	..	6·4	..	8·8	..	11·4	..	14·4	..	17·9
71	..	·2	..	·7	..	1·6	..	2·8	..	4·4	..	6·3	..	8·6	..	11·2	..	14·2	..	17·6
72	..	·2	..	·7	..	1·6	..	2·8	..	4·3	..	6·3	..	8·5	..	11·1	..	14·0	..	17·4
73	..	·2	..	·7	..	1·5	..	2·7	..	4·3	..	6·2	..	8·4	..	11·0	..	13·8	..	17·1
74	..	·2	..	·7	..	1·5	..	2·7	..	4·2	..	6·1	..	8·3	..	10·8	..	13·6	..	16·9
75	..	·2	..	·7	..	1·5	..	2·7	..	4·2	..	6·0	..	8·2	200·1	10·7	..	13·4	..	16·7
76	..	·2	..	·7	..	1·5	..	2·6	..	4·1	..	5·9	..	8·1	..	10·5	..	13·2	..	16·4
77	..	·2	..	·6	..	1·5	..	2·6	..	4·1	..	5·8	..	8·0	..	10·4	..	13·0	250·2	16·2
78	..	·2	..	·6	..	1·4	..	2·6	..	4·0	..	5·8	..	7·9	..	10·2	..	12·9	..	16·0
79	..	·2	..	·6	..	1·4	..	2·5	..	4·0	..	5·7	..	7·8	..	10·1	..	12·8	..	15·8
80	..	·2	..	·6	..	1·4	..	2·5	..	3·9	..	5·6	..	7·7	..	10·0	..	12·7	..	15·6

TABLE II.—CURVES FROM 85 CHAINS TO 280 CHAINS, OR 3½ MILES RADIUS.

Radius of the Curve.	Length of the Tangent in Chains.																			
	1		2		3		4		5		6		7		8		9		10	
	t	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*
Chains.	Links.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.
85	50·0	0·6	100·0	2·4	150·1	5·3	200·1	9·4	250·2	14·7	300·4	21·2	350·6	28·9	400·9	37·7	451·4	47·8	501·7	59·0
90	..	..	..	2·2	150·0	5·0	..	8·9	..	13·9	300·3	20·0	..	27·3	400·8	35·6	451·1	45·1	501·6	55·7
95	..	0·5	..	2·1	..	4·7	..	8·4	..	13·2	..	19·0	350·5	25·9	400·7	33·7	451·0	42·7	501·4	52·8
100	..	..	..	2·0	..	4·5	..	8·0	..	12·5	..	18·0	350·4	24·6	400·6	32·0	450·9	40·6	501·3	50·1
105	..	..	..	1·9	..	4·3	..	7·6	..	11·9	..	17·2	..	23·4	..	30·5	..	38·7	501·1	47·7
110	..	..	..	1·8	..	4·1	..	7·3	250·1	11·4	300·2	16·4	350·3	22·3	400·5	29·1	450·8	36·9	501·0	45·5
115	..	0·4	..	1·7	..	3·9	..	7·0	..	10·9	..	15·7	..	21·3	..	27·8	450·7	35·3	..	43·5
120	..	..	..	..	..	3·8	..	6·7	..	10·4	..	15·0	..	20·4	400·4	26·7	450·6	33·8	500·9	41·7
125	..	..	..	1·6	..	3·6	..	6·4	..	10·0	..	14·4	..	19·6	..	25·6	..	32·4	500·8	40·0
130	..	..	..	1·5	..	3·5	200·0	6·2	..	9·6	..	13·9	..	18·8	..	24·6	450·5	31·1	..	38·5
135	..	..	..	..	..	3·3	..	5·9	..	9·3	300·1	13·3	350·2	18·1	400·3	23·7	..	30·0	500·7	37·1
140	..	..	..	1·4	..	3·2	..	5·7	..	8·9	..	12·9	..	17·5	..	22·9	..	29·0	..	35·8
145	..	0·3	..	..	..	3·1	..	5·5	..	8·6	..	12·4	..	16·9	..	22·1	450·4	28·0	500·6	34·5
150	..	..	..	1·3	..	3·0	..	5·3	..	8·3	..	12·0	..	16·3	..	21·3	..	27·0	..	33·4
155	..	..	..	..	..	2·9	..	5·1	..	8·1	..	11·6	..	15·8	..	20·6	..	26·2	500·5	32·3
160	..	..	..	1·2	..	2·8	..	5·0	250·0	7·8	..	11·3	..	15·3	400·2	20·0	..	25·4	..	31·3
165	..	..	..	..	..	2·7	..	4·8	..	7·6	..	10·9	350·1	14·8	..	19·4	450·3	24·6	500·4	30·3
170	..	..	..	..	..	2·6	..	4·7	..	7·3	..	10·6	..	14·4	..	18·9	..	23·9	..	29·4
175	..	..	..	1·1	..	..	..	4·6	..	7·1	..	10·3	..	14·0	..	18·3	..	23·2	..	28·6
180	..	..	..	..	..	2·5	..	4·4	..	6·9	..	10·0	..	13·6	..	17·8	..	22·5	500·3	27·8
185	..	..	..	..	..	2·4	..	4·3	..	6·7	..	9·7	..	13·2	..	17·3	..	21·9	..	27·1
190	..	..	..	..	..	..	..	4·2	..	6·6	..	9·5	..	12·9	..	16·8	..	21·3	..	26·4
195	..	..	..	1·0	..	2·3	..	4·1	..	6·4	..	9·2	..	12·6	..	16·4	450·2	20·8	..	25·7
200	..	0·2	..	..	..	..	..	4·0	..	6·3	..	9·0	..	12·3	..	16·0	..	20·3	..	25·0
205	..	..	..	..	..	2·2	..	3·9	..	6·1	..	8·8	..	12·0	400·1	15·6	..	19·8	..	24·4
210	..	..	..	..	..	..	..	3·8	..	6·0	..	8·6	..	11·7	..	15·3	..	19·3	..	23·8
215	..	..	..	0·9	..	2·1	..	3·7	..	5·8	..	8·4	..	11·4	..	14·9	..	18·8	..	23·2
220	..	..	..	..	..	..	..	3·6	..	5·7	..	8·2	..	11·1	..	14·6	..	18·4	..	22·7
225	..	..	..	..	..	2·0	..	..	..	5·6	..	8·0	..	10·9	..	14·2	..	18·0	500·2	22·2
230	..	..	..	..	..	..	..	3·5	..	5·4	..	7·8	..	10·7	..	13·9	..	17·6	..	21·7
235	..	..	..	..	..	1·9	..	3·4	..	5·3	..	7·6	..	10·4	..	13·6	..	17·2	..	21·3
240	..	..	..	0·8	..	..	..	3·3	..	5·2	300·0	7·5	..	10·2	..	13·3	..	16·9	..	20·8
245	..	..	..	..	..	1·8	..	..	..	5·1	..	7·3	..	10·0	..	13·0	..	16·6	..	20·4
250	..	..	..	..	..	..	..	3·2	..	5·0	..	7·2	..	9·8	..	12·8	..	16·2	..	20·0
255	..	..	..	..	..	..	..	3·1	..	4·9	..	7·0	..	9·6	..	12·5	450·1	15·9	..	19·6
260	..	..	..	..	..	1·7	..	..	..	4·8	..	6·9	..	9·4	..	12·3	..	15·6	..	19·2
265	..	..	..	0·7	..	..	..	3·0	..	4·7	..	6·8	..	9·2	..	12·1	..	15·3	..	18·8
270	..	..	..	..	..	..	..	..	..	4·6	..	6·7	..	9·0	..	11·8	..	15·0	..	18·5
275	..	..	..	..	..	1·6	..	2·9	..	4·5	..	6·5	..	8·9	..	11·6	..	14·7	..	18·2
280	..	..	..	..	..	..	..	..	..	..	..	6·4	..	8·8	..	11·4	..	14·4	..	17·9

TABLE III.—CURVES FROM 300 CHAINS TO 640 CHAINS, OR 8 MILES RADIUS.

Radius of the Curve.	Length of the Tangent in Chains.																			
	2		4		6		8		10		12		14		16		18		20	
	t	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*		*o*	*t*	*o*	*t*	*o*	*t*	*o*
Chains.	Links.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.
300	100·0	0·7	200·0	2·7	300·0	6·0	400·1	10·7	500·1	16·7	600·2	24·0	700·4	32·7	800·6	42·7	900·8	54·0	1001·1	66·7
320	..	0·6	..	2·5	..	5·6	..	10·0	..	15·6	..	22·5	700·3	30·6	800·5	40·0	900·7	50·6	1001·0	62·6
340	..	..	..	2·3	..	5·3	..	9·4	..	14·7	..	21·2	..	28·8	800·4	37·7	900·6	47·7	1000·8	58·9
360	..	..	..	2·2	..	5·0	400·0	8·9	..	13·9	..	20·0	700·2	27·2	..	35·6	..	45·0	1000·7	55·6
380	..	0·5	..	2·1	..	4·7	..	8·4	..	13·1	..	19·0	..	25·8	..	33·7	900·5	42·7	..	52·7
400	..	..	..	2·0	..	4·5	..	8·0	..	12·5	600·1	18·0	..	24·5	800·3	32·0	900·4	40·5	1000·6	50·0
420	..	..	..	1·9	..	4·3	..	7·6	..	11·9	..	17·1	..	23·3	..	30·5	..	38·6	..	47·6
440	..	..	..	1·8	..	4·1	..	7·3	..	11·4	..	16·4	..	22·3	800·2	29·1	..	36·8	1000·5	45·5
460	..	0·4	..	1·7	..	3·9	..	7·0	..	10·9	..	15·6	..	21·3	..	27·8	900·3	35·2	..	43·5
480	..	..	..	..	..	3·8	..	6·7	..	10·4	..	15·0	700·1	20·4	..	26·6	..	33·8	..	41·7
500	..	..	..	1·6	..	3·6	..	6·4	..	10·0	..	14·4	..	19·6	..	25·6	..	32·4	1000·4	40·0
520	..	..	..	1·5	..	3·5	..	6·2	500·0	9·6	..	13·8	..	18·8	..	24·6	..	31·2	..	38·4
540	..	..	..	..	..	3·3	..	5·9	..	9·2	..	13·3	..	18·1	..	23·7	..	30·0	1000·3	37·0
560	..	..	..	1·4	..	3·2	..	5·7	..	8·9	..	12·8	..	17·5	..	22·9	900·2	28·9	..	35·7
580	..	0·3	..	..	..	3·1	..	5·5	..	8·6	..	12·4	..	16·9	..	22·1	..	27·9	..	34·5
600	..	..	..	1·3	..	3·0	..	5·3	..	8·3	..	12·0	..	16·3	800·1	21·3	..	27·0	..	33·3
620	..	..	..	..	..	2·9	..	5·2	..	8·1	..	11·6	..	15·8	..	20·6	..	26·1	..	32·3
640	..	..	..	..	..	2·8	..	5·0	..	7·8	..	11·3	..	15·3	..	20·0	..	25·3	1000·2	31·3

rule it will be greatest where most needed—for instance, when a light superstructure is bedded in clay, in a northern climate.

The distribution of the weight of the engine on 8 wheels, instead of throwing three-fifths or more on 2 wheels, is therefore intimately connected with the continuance of a cheap superstructure, which has been, and will be, even with the present engines, extensively used in many parts of the country, where capital and good mechanics are scarce and timber and axe-men abundant. Owing to the increased deflection of the wooden rail there will of course be a loss of power, but this, even now not very important, will be reduced one-half by the distribution of the weight on all the wheels, besides which the only fear is, that full loads will only too seldom be obtained for the lightest class of engines, built on this principle, even with grades of from 40 to 60 feet per mile.

I have been informed by my friend Mr. E. F. Johnson, (the other engineer alluded to in a preceding paragraph) that a trial of this new engine has been made, and that it appears to work well. Time and experience can however alone develop its powers, expose its defects and give unerring proof of its general and successful adoption. But supposing, what is most unlikely, that this experiment should lead to no useful result, we have still the 8 wheeled engine of Messrs. Eastwick and Harrison (or Mr. H. R. Campbell?) which is capable of drawing 100 tons nett up an inclination of 60 feet per mile, and which will be less injurious to the superstructure than the ordinary 8 or 9 tons English or American engine.

An extremely interesting and still more useful experiment may very easily be made with the engine of Messrs. E. & H., or still better, with that of the Messrs. Stevens. Remove the couplings so that the engine may act by the adhesion of one pair of wheels only, and ascertain the maximum load without slipping the wheels; then couple 2 pair of wheels, repeat the experiment and the increase of load will show the value of the improvement of Messrs. E. & H. With the 8 wheeled engine, 4 such experiments should be made, by which the advantages of this mode of construction would be determined with considerable accuracy, and all requisite information afforded on this vital, and hitherto much neglected principle, of working by the adhesion of more than 2 wheels.

The successful introduction of engines with the weight distributed equally on, and acting by the adhesion of 8 wheels, would form an era in the history of railways in the United States, second only, to that which determined the general question of the practicability of locomotion by steam—in other words, that which gave its present importance to this unrivalled mode of communication.

ON THE DRAUGHT OF CARRIAGES AND ON SECONDARY FRICTION. By M. Dupuit, C. E.

(Translated from the French.)

1. Draught of Carriages.

By allowing wheels of diameters varying from 4 feet to 7 feet to run down an inclined plane, and by measuring the spaces run over on horizontal ground, by virtue of the fall, we find that they are proportional to the square roots of the diameters, and height of the fall, whatever may be the weight or breadth of the tire. From this we derive the four following laws:—

The draught is proportionable to the pressure;
independent of the breadth of the tire;
independent of velocity;
in inverse ratio of the square root of the diameter.

These four laws are the same as established by the author of this paper in his Essay on the Draught of Carriages, published in 1837, and which he had found by means of a simple dynamometer. The three last are completely in contradiction to those which M. Morin deduced from the experiments made with his dynamometrical apparatus.

2. Secondary Friction of Rolling.

The resistance which opposes the rolling of a body is nothing more than the molecular action, which takes place on contact. This reaction, always equal to the pressure, passes by the normal when the body is at rest, and advances in front by a certain quantity δ when it rolls; it therefore resists the rolling with a power marked $P\delta$.

Following up this single property of solid bodies, of being an assemblage of molecules in equilibrium, we arrive at the following expression of the friction of rolling:

$$T = \frac{P}{\sqrt{2R}} F.\left(\frac{P}{aL\sqrt{2R}}\right),$$

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which gives all the properties of this resistance in friction with one of them. If we follow up that of being proportional to the pressure, which is not denied by any one, we rediscover the three other laws pointed out above, which establishes a mutual confirmation of the experiments and the theory. The friction of rolling being an immediate consequence of the imperfect elasticity of bodies, we may, by its properties, ascertain those of elasticity; whence we deduce the following:—

When we subject the surface of a body to pressure, we obtain under this pressure a certain instantaneous sinking e', which reduces itself at last to a slight impression e, when the pressure ceases. This impression e is proportional to the square root of the definitive sinking e'.

The friction of rolling is proportional in the relation of $\frac{e}{\sqrt{e'}}$, in such a way that it is determined by two coefficients which define the elasticity of a body. For want of these two coefficients we may substitute two others. Knowing 1st, The friction of iron upon iron, and of iron upon marble, we may deduce immediately from it the friction of iron upon copper. Thus for twenty surfaces, forty coefficients would be enough to determine 380 to which their combinations two by two would give rise.

When two curved surfaces roll one upon another, the result of the molecular action, equal to the pressure, no longer passes in the direction of the normals, but parallel in the direction of the velocity, at a distance, proportionable to the square root of the product of the rays or radii of curve, divided by their sum or difference, accordingly as they are both convex or one of them concave.

This formula resolves all the problems relating to the calculation of the resistance to rolling, and it is capable of numerous practical applications.

3. Action of Wheels upon Roads.

Although the draught is to a certain point the expression of the derangement of the materials of the road, it is quite inaccurate to conclude therefrom that the degradation is proportional to the draught. By keeping the roads constantly even, which is always possible, the passages are divided uniformly on the whole pavement;* then the small displacements which they occasion destroy each other. Besides in a number of cases the result of the passage of a carriage is to produce an improvement. In a good system of road making, the roads are never degraded, whatever may be the traffic, they are only worn. It cannot be a question, in a road law, of having good or bad roads, but only of spending more or less for their maintenance. Every restriction of the freedom of a road is to the carriers a cause of increased expence, greater than the saving which might be made in the expences of keeping up the roads.

PAPERS ON ARTESIAN WELLS.

Observations undertaken for the purpose of estimating the height to which the Water might rise in the Well bored in the Abattoir de Grenelle, by M. Walferdin. *Read before the Academie des Sciences.*

The water which springs up from Artesian sources does not always rise above the level of the soil, sometimes it is several yards lower, and in this case it is brought to the surface by mechanical means; sometimes it reaches it; and at other times it rises more or less above the surface. That as it is well known depends upon the difference of height at which the water arrives across permeable strata, between the impermeable strata which contain it, and that of the point at which they ascend.

I have considered that in the advanced state of the borings at Grenelle, that it might be useful to compare the height at which are filtered the waters which form the supply which is sought under the Paris basin, and that of the surface of the soil at Grenelle.

If, by ascending the natural slope which the waters follow to the surface of the earth, we seek the chalk boundary in the southwest direction, we find it cease in the neighbourhood of Troyes. Then the gault marls and clays which the bore now crosses at Grenelle succeed the chalk, and at about eleven miles from Troyes, near Lusigny, the green sand appears, and forms the orifices by which the waters begin to filter.

The height at which the waters thus penetrate the sands being near Lusigny, 135 or 140 yards above the level of the sea, and that of the surface at Grenelle 40 yards only, it follows that when the bore reaches the layer of water at Paris, that the water will rise sensibly above the surface.

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* It must be remembered that M. Dupuit is talking of French roads.—Ed.

CALCULATING BALANCE FOR ENGINEERS.

BY M. LEO LALANNE, C. E.

(Translated from the French.)

It is often necessary to multiply by each other the terms of two series, and to divide the sum of the products by the sum of one of the series. This calculation, which gives a kind of mean, is that used to find the centre of gravity, to determine certain probabilities, and to solve various questions, which occur in all the mathematical and physical sciences. M. Lalanne has conceived the idea of performing this operation by means of a kind of Roman balance loaded with different weights, and on which the quotients required can be read off on a scale, and obtained with that degree of approximation which allows the representations of numbers by distances and weights.

The plan of this machine is formed on the following considerations:—If we distribute on one of the arms of a balance weight, which are proportional to the terms of a series, and if we place them at distances from the point of suspension, which represent the terms of a second series, if on the second arm of the balance we suspend an equal weight to the sum of the weights already placed on the first arm, it is clear that the distance at which this total weight must be made to act for the equilibrium, will be the sum of the products of the opposed weights, multiplied respectively by their distances from the axis, and divided by the sum of the weights. So much the more exactness will be obtained in this result if the weights and distances are more exactly proportional to the terms of the two series which are to be operated upon, and as the balance is made more sensible.

M. Lalanne intends his instrument principally to assist engineers in calculating the mean distances of transports. We know that in these calculations we must take the sum of the products of the cubes to be transported by the distances which correspond to them, and divide the sum of these products by the total cube. If, then, we take weights which represent partial cubes, and if we place them on one of the arms of the balance, at distances which represent those of the transports; if, at the same time, we place a partial weight on one side of the balance, an equal one is placed in a scale suspended from a very precise point of the other arm, and this point may be moved about until equilibrium is effected, its distance from the axis of suspension will represent the mean distance sought.

In M. Lalanne's balance, the upper part of the beam is divided into 150 compartments, each two millimetres broad; upon it are placed the weights—the distances thus taken from a hundred and fiftieth part nearly up to 600 metres. The volumes are represented by the weight, a cubic metre answering to five milligrammes, a total of 20,000 cubic metres, may easily be operated upon with the approximation of one of these units.

An experiment was made on the comparative duration of the times necessary to obtain a mean by this instrument, and also by ordinary arithmetical calculation—a calculation which required fifty minutes to execute once without verification, was done by the machine in twenty minutes, with only the chance of a very slight error. Thus the time necessary is reduced at least by two fifths, giving besides a security against great errors, and it would be reduced to a quarter if the ordinary arithmetical calculations had been verified. Although the instrument can only give an approximation, and as in all graphic operations, we have not the exact figure of the result, nevertheless the saving of time is great enough to show the utility of it to engineers.

BALISTIC CLOCKS,

FOR ASCERTAINING THE POWER OF GUNPOWDER.

(Translated from the French.)

These clocks were constructed in 1836, in the Arsenal of Metz, the Woolwich of France, by Messieurs Piobert and Morin, and from the nature of the experiments made with them, were formed so as to fulfil the following conditions:—

1st The suspension of the cannon clock must be susceptible of receiving easily and at little expense, cannons and howitzers of every calibre.

2nd The machine must be sufficiently light for its susceptibility to be great enough for small calibres, and small charges, and nevertheless the recoils must not exceed certain limits in heavy charges.

3rd The balistic receiver must be susceptible of receiving without injury, the shock of projectiles of all calibres, propelled with the greatest speed that powder can communicate to them, and be entirely constructed of metal to avoid the effects of hygrometricity and the corrections which it necessitates for wooden clocks.

4th The mechanical requisite of having the centres of oscillation on the line of fire being absolutely necessary for all calibres, required easy means of effecting it.

The detailed reasons which led the inventors to adopt forms almost totally different from those of the old productions of Hutton, and those which had been established at the powder factory of Esquerdes, have been already published by them.

From a summary description of the apparatus, M. Morin shows, by the results of experiments conducted by Captain Didion, Professor at the School of Application at Metz, how great is the accuracy of these instruments. Thus, in the fire of a sixteen-pounder, (about eighteen English,) loaded with a charge of 4lb. 6oz., of four shots fired with charges prepared with care, the speed given to the ball did not differ more than 2 feet 7in, $\frac{1}{380}$ of its mean value, 462·7 metres.

Among other remarkable experiments, these instruments have been used by M. Didion to determine in an accurate manner the charge of powder, beyond which the velocity ceases to increase in 12-pounders (French), and which more than 17½lb., that is to say, much more than the weight of the ball.

Besides, this extraordinary fire, the same apparatus has been used to measure results much superior, since by their means have been ascertained velocities of 660 metres in a second, communicated by particular powder to a 24 pounder shot.

In fine, by firing with a 12-pounder garrison gun, common shells of 12 inch calibre, weighing 4.010 kil., with a charge of 6 kil., they obtained a velocity of 745·3metres in a second, which is the greatest that man has ever yet been able to communicate to moveable bodies.

The machines have satisfactorily answered the purposes for which they were intended, so that the Minister of War has had others made, which have just been set up at the powder works of Bouchet, near Arpajon, and he has ordered a third set for that of Toulouse.

In conclusion, the principle, and general arrangement, of these clocks has been applied by M. Morin to the construction of a wooden clock, of which the receiver closed with a wooden barrel, five feet diameter, will receive the shock of a projectile fired at variable distances of 50, 100, or 150 yards to determine the effects of the resistance of the air. These experiments are already in course of operation by Captain Didion, at Metz, and they afford positive data, and the bases of experimental balistics, so necessary for artillery practice.

PENZANCE HARBOUR.

Extracts from the Report on the improvement of the Harbour of Penzance, by
HENRY R. PALMER, F.R.S.

GENTLEMEN,—In obedience to the instruction of the Town Council, given to me through George D. John, Esq., the Town Clerk, I have endeavoured, as far as lay in my power, to acquaint myself with all those circumstances on which the improvement of your harbour depends; and by a careful consideration of them to prepare such suggestions as I trust may be conformable with your wishes.

The principal observations which I collected referred to an undulatory motion of the water which is invariably felt when the wind is high, and to an occasional "lifting" of the waters arising from distant causes.

The undulating motion of the water is experienced at the extremities of all bays, the beds of which form a gradual slope towards the shore, like that which is under consideration, and the effect can only be reduced by an alteration in the form of the surface, and by a protection from the action of the winds.

It being obvious that the improvement of the harbour must consist mainly in the erection of an additional pier, I was anxious to have the opinions of the nautical men as to the best situation and form of the entrance; and, also, upon the width of the opening. Upon the situation of the entrance southward and northward, there was no important difference of opinion; but it was thought advisable to advance the entrance, if practicable, into deeper water than that at the head of the present pier. The relative positions of the pier head were discussed at some length; and there was a manifest difference of opinion on that point. It is, indeed, one on which it is very difficult to decide *à priori*. I am not acquainted with more than one pier harbour, the entrance to which was so designed originally as to be in all respects satisfactory when carried into effect; and in laying down the plan, which I have now the honour to submit to the council, I have thought it prudent so to arrange the position of the pier heads, as to admit of their being finally adjusted as experience acquired in the progress of the work may dictate.

For the satisfaction of the council, I have deemed it advisable to lay before them plans of other pier harbours. By help of these, some comparisons may be formed with that proposed for Penzance, not only in relation to their extent, but also to their security. They are as follow:—

Ramsgate—Dover—Folkestone—Swansea.

The harbour of Ramsgate is entirely artificial; and is constructed on a shore directly opposed to the prevailing winds. Its security is therefore exclusively derived from the piers by which it is enclosed. The width of the entrance was originally 300 feet, and open due south. The exposure to vessels moored in the harbour, was such as to induce the necessity for an additional protection; and the eastern pier was extended as shown in the drawing, and the width of the entrance reduced to 200 feet exposed directly to the south west, or the most prevalent winds. From this circumstance it may be readily inferred, that, during gales from the quarter last mentioned, Ramsgate harbour offers but little security.

Dover harbour is less exposed than that of Ramsgate, but it is frequently rendered inaccessible by the accumulation of shingle, of which the beach is composed. The direction and position of the piers, which define the entrance to Dover harbour, have been, for the most part, designed with a view to avoid the difficulties arising from the accumulation of the shingle, rather than as a protection against the effect of the winds. The entrance is 150 feet in width, and is open near due S.E.

Folkestone harbour has advantages over all the others on the same coast, in reference to its position. It is the most easily accessible, and is well protected against the effect of the south-westerly winds. It is, however, rendered very imperfect, and the entrance to it sometimes impracticable by the same causes, which so much deteriorated the value of Dover harbour. It is frequently necessary to remove the shingle from the mouth of it by manual labour. But, in other repects, the position of the entrance in relation to the prevailing wind is very favourable. The mouth faces the S.E.E., and is 100 feet in width.

Swansea harbour is the most extensive artificial harbour on the British coast. It is situated in the Bay of Swansea; and has the advantage of a river flowing through it, by which a considerable portion of the bed is cleansed, and its depth preserved. The mouth is 300 feet in width, and is exposed nearly due S.W. The slope of the bed is such as to occasion a considerable ground swell when the wind is strong from the prevailing quarter.

The chief quality of the entrance to Folkestone harbour is derived from the angles of the line of its mouth with that of the prevailing winds. The angle is about 39 degrees, which forms an angle 210 degrees with the line of action of the wind referred to.

The wind agains which the most protection is required at Penzance is S.S.E. The angle of the line of entrance as drawn in the plan is 45 degrees with that bearing, or 200 degrees with the line of force. As before observed, the positions of the pier heads are so arranged, that that angle may be increased, if by experience the necessity for so doing may be evinced.

With reference to the width of the entrance of the intended harbour, the same latitude will be preserved as with the direction of it, for it is impossible to determine beforehand with certainty, what width will, under all the circumstances, be most advantageous. In the first place I have assumed 175 feet.

Having adverted to the first and most important point to be decided, I have now to describe the general design for the harbour.

In the first place, I have endeavoured to include as great an area of ground as possible within the limits of the property of the corporation. The northern pier is drawn near about the line of low water of spring tides. Its direction forms an angle of 20 degrees with that of the S.S.E. wind.—The capability of the pier to resist the action of the sea is therefore satisfactory. The surface of the pier is proposed to be 30 feet in width, exclusive of the parapet wall. The pier is proposed to terminate at the northern extremity of the town property.

The pier is proposed to be constructed with granite, and the interior between the walls to be filled with the stones obtained by the excavation in the harbour. A considerable length of the northern portion of the pier need not be walled in the substantial manner required where it is more exposed, and in deeper water. Rubble work, laid with a long slope on the face in the part referred to, will not only be more economical, but will also form a better termination than a perpendicular wall, in as much as it will gradually divert and disperse the action of the sea.

It being the opinion of many of the nautical men that some advantage would be derived by the extension of the southern pier; and considering that the extremity of it may require repair and support, I have proposed an addition to it of 50 feet.

It may be proper here to remark that although I have included by the proposed pier the greatest area available within the limits of the corporation property, the pier as designed will cost a less sum than would have been requisite for a more limited inclosure in the northern direction.

The whole area thus to be enclosed will exceed 40 acres; and there can be no doubt that such a work alone would be one of great value and importance; but still it would be deficient by the total recession of the tidal water from it. The area, however, is such as to allow of a portion being abstracted from it for the purpose of a floating dock. In the plan I have represented a portion so abstracted to the extent of ten acres, a communication being made between the harbour and the dock, by means of a lock, capable of passing vessels of 500 tons burthen.

The division wall is represented near to a lane called Neddy Bettey's Lane. The lock is so placed as to enable vessels to be passed through conveniently and with safety.

It is proposed to form a quay along the boundary of the dock, which will admit of the erection of warehouses, which being built upon arches, will not prevent the traffic of carriages along the quays.

I have not laid down any design for a quay along the front of the town, but, have represented by a dotted line what I conceive should be the limits of a quay if such should hereafter be decided upon.

At the southern extremity of the harbour I have represented a boundary line, including a space which appears to me to be peculiarly suited for a ship yard, in as much as it will be a convenient situation for launching.

In considering the various circumstances affecting the general design, I have had especial reference to the practicable operation of executing it.—This is peculiarly important, where the work is exposed in its progress to the violent action of the sea; and I have no hesitation in stating distinctly that for the execution of the work, with due regard to economy, and to avoid damage to it by the sea whilst it advances, it will be necessary to commence at the northern extremity, and proceed regularly, making all its parts perfect as they are severally produced.

This view of the case constitutes an additional, if not alone a sufficient argument in favour of continuing the sea wall to the point mentioned.

In conclusion, I must beg permission to state that the shortness of the time within which it has been necessary for me to furnish my plan and report has not been permitted me to obtain and furnish them in so complete a state as they should have been presented in.

Certain sections, soundings, and measurements, are necessary, and yet wanting; and, indeed, before the subject can be continued beyond what is necessary for the Parliamentary proceedings, a complete survey made for the particular objects in view will be indispensable; and it will be equally important to obtain a series of observations upon the tides, about which I have not yet been able to collect any precise or valuable information.

In forming an estimate of the expence of the works, I have been obliged, from the absence of sufficient accurate data, to assume a larger consumption of materials than I believe will be required, in order that the error may be on the safe side; and hence, I can, with confidence, state that the sums annexed will be more than sufficient for the execution of the works proposed.

ESTIMATE OF EXPENCE.

Erecting a northern pier, as represented in the drawing. Making an addition of 50 feet to the present pier; and thus constituting a safe and commodious harbour	£24,000
Erecting a cross wall for the construction of a floating dock of ten acres in area, with a ship lock, and tide gates, and swivel bridge, and forming quays along the boundary of the dock	8,500
Parliamentary and law expenses, engineering, &c., say	2,500
	£35,000

ROYAL SOCIETY.—THE PRESIDENT'S ADDRESS.

THE following is the address of the President (the Marquis of Northampton), at the meeting of the Society on the 5th ultimo.

GENTLEMEN—A year having now elasped since you conferred upon me the highly honourable office of your President, it becomes my duty, in accordance with the example of my predecessors, to address you. The first and most agreeable part of my task is to express my feelings of gratitude to those Gentlemen whom you were pleased to select as my Council. * *

The past year has indeed been to that portion of the Royal Society which takes an active part in its affairs, one of more than usual labour and exertion, —of labour and exertion, destined, as I hope, to produce rich and ample fruit. The great and marking peculiarity which has attended it, has been the sailing of the Antarctic Expedition. The importance of following up in the southern regions of the globe the magnetic inquiries so interesting to men of science in Europe, was strongly felt by one of our distinguished Fellows, Major Sabine, and by him brought before the notice of the British Association at their meeting at Newcastle, as he had also previously done at Dublin. That great assemblage of men of science, concurring in the views of Major Sabine, resolved to suggest to Her Majesty's Government the propriety of sending out a scientific expedition; and the Royal Society lost no time in warmly and zealously seconding the recommendation: and, in compliance with the request conveyed to us by the First Lord of the Admiralty, the Council transmitted to the Government a body of hints and instructions in different branches of science, which I trust are likely to be of material use both to the principal and to the subsidiary objects of the Antarctic Expedition. These hints and instructions would have been far less extensive and efficient if the Council had not been able to have recourse to the several Scientific Committees, of whose formation the Society is already aware. The Expedition has now sailed, amply provided with the best scientific instruments, and furnished with ample scientific instructions: it is commanded by one well acquainted both with magnetic inquiry and nautical research. We may therefore hope that, with the blessing of Providence, it will return with a store of knowledge valuable to the geographer, to the geologist, to the meteorologist, and to him also who studies the marvels of vegetable and animal life. In addition to all this we may hope, that the main object of the Expedition will be accomplished by additional light thrown on the obscure problems which still attend the magnetism of the earth, and that by such discoveries Captain James Clark Ross may not only add to his own reputation and his country's glory, but also give to the adventurous mariner increased facility and security in traversing the pathways of the ocean. The Antarctic Expedition was not the only measure recommended by the Royal Society and the British Association to Her Majesty's Government. Another important recommendation, which had previously been brought forward by Baron Humboldt, was the establishment of fixed magnetic observatories for the purpose of making simultaneous observations in different parts of our colonial possessions. These recommendations have been readily acceded to, both by the Government and by the Directors of the East India Company, and probably, ere many months shall have elapsed, the observatories will be in full activity.

I have stated, Gentlemen, that your Council had recourse to the Scientific Committees for assistance in drawing up instructions for the Expedition in different branches of knowledge; those committees, who were named only two years ago, were at first apparently more a matter of form than substance; they have now been found capable of doing excellent service. Not only has your Council consulted them on the questions already alluded to, but also, observing that the several Committees are composed of the most competent judges of the merits of the memoirs in the respective departments of science communicated to the Society, they have, in general, referred the papers to them to report upon previously to coming to a decision regarding their publication. The Royal Society, from its character of pursuing every branch of physical science, is evidently in a different position from other societies professing some one science alone. It may be reasonably expected, that in the Botanical or Geological Society, for instance, the whole Council should possess a certain degree of botanical or geological knowledge. This, however, cannot be the case with us. Our Council will comprise a few astronomers, a few zoologists, a few botanists, and a few persons well acquainted with geology and medicine; but no single science can monopolize a large number of its members. In difficult questions we have therefore felt that it is more satisfactory to ourselves, and we think probably more so to the general body of the society, and to those who have favoured us with papers, that we should ask the opinion of a larger number of men conversant with the immediate sciences in question. At the same time, the Council retains its responsibility for its acts, and the chief officers of the society are officially members of each of the scientific committees. The Council have derived a further assistance from these Committees in the adjudication of our medals. In naming these Committees, the Council has had both a difficult and a delicate task. Convinced that bodies, when too numerous, are little adapted for business, they have also felt that the power of giving their attendance might be more important than absolute superiority of scientific attainments. Some members have, however, been selected, though really non-resident, because it was believed that their colleagues might wish to consult them by letter. With these objects and views, the Council have done their best; but they have little doubt that some gentlemen have been overlooked and omitted, whose presence in the Committees might have been very desirable. The Society must consider this as in some degree a new system, to be perfected and improved by experience alone. Another question has occupied a share of the time of the Council during the last year. We have felt that the testimonial of recommendation for new Fellows has scarcely been sufficiently definite and precise in stating the grounds on which the candidate was recommended to the body of the Society. We have therefore thought it desirable to draw up forms of testimonial, some one of which may be adopted as most fit for each individual so recommended. We have thought this more fair, at the same time, to the meritorious candidate and to those electors who are otherwise left in the dark with respect to his claims for their suffrages. We hope and trust that this new regulation will not stand in the way of any candidate who would be a desirable addition to our number.

The vacancies in the list of our Foreign Members have been supplied by the election of M. Savart of Paris, Signor Melloni of Parma, M. Quetelet of Brussels, M. Hansteen of Christiana, Prof. Agassiz of Neufchatel, and M. von Martius of Münich, as those Fellows who were present at their election will remember.

I have to announce to you, Gentlemen, with great regret, the retirement of Captain Smyth from the office of Foreign Secretary, in consequence of his leaving his present residence for one at an inconvenient distance from London.

I have the honour, Gentlemen, to inform you that the Council have, by an unanimous decision, awarded the Royal Medals to Dr. Martin Barry and Mr. Ivory, and the Copley Medal for the year to Mr. Robert Brown; and I shall now beg leave to address myself to those three Gentlemen.

Dr. Barry.—It gives me sincere pleasure to bestow this medal on a gentleman who has so well deserved it, by researches in a difficult and important portion of animal physiology.. Your merits have been appreciated by men much more capable of understanding the subject than I can pretend to be—by men selected by the Council of the Royal Society for their physiological science, who have felt the great value of the discoveries you have made by accurate and diligent research, aided by the skilful use of the microscope. I trust that the award of this medal will encourage you to persevere in the same course, and that future discoveries may add to your reputation and to that of the important profession to which you belong.

Mr. Ivory—It is not the first time that you have been addressed from this chair, and it gives me great satisfaction to follow the steps of my predecessors, Sir Joseph Banks and Sir H. Davy, by again bestowing a medal on one who is an honour to the Royal Society, and pre-eminently distinguished for his mathematical attainments. The labours of your life are too well known to the scientific world to require any eulogium from me, and I consider that in this tribute to your paper on astronomical refraction, we are rather doing an honour to ourselves than to you.

Mr. Brown—In conferring the Copley Medal on you for your valuable discoveries in vegetable impregnation, I am quite sure that the voice of scientific Europe will respond to the decision of the Council of the Royal Society. The Académie des Sciences has already pronounced on your merits, as also on those of Mr. Ivory, by electing you as well as that gentleman to a seat among their foreign members: and the University of Oxford has also, by an honorary degree, given you a similar testimonial. That you are one of our Fellows is to myself a circumstance peculiarly agreeable, as it must be to the whole body over whom I have the honour to preside. Your discoveries in the particular botanical question, for which I have to give you the Copley Medal, are so important, not only in a botanical, but also in a general scientific point of view, by showing the close analogies of animal and vegetable life, that the Committee of Zoology have felt it as much their province as that of the Committee of Botany, to recommend that the Copley Medal should be bestowed upon you; and the Council have come to an unanimous resolution to give it, though at the same time other gentlemen were recommended by other scientific committees, with whom even an unsuccessful rivalry would be no mean praise. I hope, Mr. Brown, that you may long enjoy life and leisure to pursue researches so valuable to science and so honourable to the country of which you are a native.

In drawing up the following notice of the losses which the Royal Society has sustained during the last year, in conformity with the practice of my predecessors, I have availed myself of the assistance of one of the Fellows, whose acquaintance with the labours of men of science peculiarly qualified him for the execution of a task which I could not myself have ventured to undertake. I therefore will not longer occupy your time by any further remarks of my own, but will conclude by the expression of my present wishes for the prosperity of the Royal Society, and for its success in furthering the noble ends for which it was instituted.

The Rev. Martin Davy was originally a member of the medical profession, which he followed, during a greater part of his life, with no inconsiderable reputation. He became a medical student of Caius College in 1787, and was elected to a fellowship in 1793, and to the mastership in 1803, the late illustrious Dr. Wollaston being one of his competitors. One of the first acts of his administration was to open his College to a more large and liberal competition, by the abolition of some mischievous and unstatutable restrictions, which had been sanctioned by long custom, and also by making academical merit and honours the sole avenue to college preferment: and he lived to witness the complete success of this wise and liberal measure, in the rapid increase of the number of high academical honours which were gained by members of his College, and by the subsequent advancement of many of them to the highest professional rank and eminence. Some years after his accession to the mastership, he took holy orders and commuted the degree of Doctor of Medicine for that of Theology, and in later life he was collated to some considerble ecclesiastical preferments. Dr. Davy had no great acquaintance with the details of accurate science, but he was remarkable for the extent and variety of his attainments in classical and general literature; his conversation was eminently lively and original and not less agreeable from its occasional tendency to somewhat paradoxical, though generally harmless speculations. He died in May last, after a long illness, deeply lamented by a large circle of friends, to whom he was endeared by his many social and other virtues.

Dr. Herbert Marsh, Bishop of Peterborough, and one of the most acute and learned theologians of his age, became a member of St. John's College in the University of Cambridge in the year 1775, and took his B.A. degree in 1780, being second in the list of Wranglers, which was headed by his friend and relation Mr. Thomas Jones, a man whose intellectual powers were of the highest order, and who for many years filled the office of tutor of Trinity College with unequalled success and reputation. Soon after his election to a fellowship, he went to Germany, where he devoted himself during many years to theological and general studies, and first became known to the public as the translator and learned commentator of Michaelis's Introduction to the New Testament. It was during his residence abroad that he published in the German language various tracts in defence of the policy of his own country in the continental wars, and more particularly a very elaborate "History of the Politics of Great Britain and France, from the time of the Conference at Pilnitz to the Declaration of War," a work which produced a marked impression on the state of public opinion in Germany, and for which he received a very considerable pension on the recommendation of Mr. Pitt. In 1807, he was elected Lady Margaret's Professor of Divinity in the University of Cambridge, an appointment of great value and importance, which he retained for the remainder of his life. On the resumption of his residence in the University, he devoted himself with great diligence to the preparation of his lectures on various important branches of Divinity, interposing a great number of occasional publications on the Catholic Question, the Bible Society, and various other subjects of political and theological controversy. In 1816 he was appointed Bishop of Llandaff; and three years afterwards he was translated to the see of Peterborough. *, * Dr. Marsh was a man of great learning and very uncommon vigour of mind, and as a writer, remarkable for the great precision of his language and his singular clearness in the statement of his argument.

Professor Rigaud.—The father of the late Professor Rigaud had the care of the King's Observatory at Kew, an appointment which probably influenced the early tastes and predilections of his son. He was admitted a member of Exeter College, Oxford. in 1791, at the early age of sixteen, and continued to reside there as fellow and tutor until 1810, when he was appointed Savilian Professor of Geometry. He afterwards succeeded to the care of the Radcliffe Observatory, and the noble suite of instruments by Bird, with which it is furnished, was augmented, on his recommendation, by a new transit and circle, so as to fit it for the most refined purposes of modern practical astronomy: and we venture to express a hope that it will shortly become equally efficient and useful with the similar establishment which exists in the sister university. Professor Rigaud published in 1831, the miscellaneous works and correspondence of Bradley, to which he afterwards added a very interesting supplement on the astronomical papers of Harriott. In 1838, he published some curious notices of the first publication of the Principia of Newton; and he had also projected a Life of Halley, with a view of rescuing the memory of that great man from much of the obloquy to which it has been exposed; he had made extensive collections for a new edition of the mathematical collections of Pappus: and he was the author of many valuable communications to the Transactions of the Royal Astronomical Society, and to other scientific journals, on various subjects connected with physical and astronomical science. There was probably no other person of his age who was equally learned on all subjects connected with the history and literature of astronomy. He died in London in March last, after a short but painful illness, which he bore with a fortitude and resignation which might have been expected from his gentle, patient, and truly Christian character.

Mr. Wilkins, Professor of Architecture to the Royal Academy—(see Journal, Vol. II. page 388.)

The Rev. Archibald Alison, senior Minister of St. Paul's Chapel, Edinburgh, was born in 1757, became a member of the University of Glasgow in 1772, and of Baliol College, Oxford, in 1775, and the degree of B.C.L. in 1784: he soon afterwards took holy orders in the English Church, and was presented to several ecclesiastical preferments by Sir William Pulteney, Lord Chancellor Loughborough, and Bishop Douglas of Salisbury. In 1784 he married the daughter of the celebrated Dr. John Gregory of Edinburgh, with whom he lived in uninterrupted happiness for forty years of his life. In 1814, he published two volumes of sermons; and at a later period, a very interesting memoir of his accomplished friend the Hon. Fraser Tytler Lord Woodhouslee. Mr. Alison was a man of very pleasing and refined manners, of great cheerfulness and equanimity of temper, of a clear and temperate judgment, and possessing a very extensive knowledge of mankind. He was habitually pious and humble-minded, exhibiting, in the whole tenor of his life, the blessed influence of that Gospel of which he was the ordained minister. All his writings are characterized by that pure and correct taste, the principles of which he had illustrated with so much elegance and beauty.

Edmund Law Lushington was born in 1766, at the lodge of St. Peter's College, Cambridge, of which his grandfather, Bishop Law, was master. He became a student, and afterwards a fellow of Queen's College in that University, and attained the fourth place on the mathematical tripos in 1787. After practising for some years at the bar, he was appointed Chief Justice of Ceylon, a station which he filled for several years with great advantage to that colony. On his return from the East, he was made Auditor of the Exchequer, and also received from his uncle Lord Ellenborough the appointment of Master of the Crown Office. He was an intimate friend of Wollaston and Tennant; and though withdrawn by his pursuits from the active cultivation of science, he continued throughout his life to feel a deep interest in its progress. His acquaintance with classical and general literature was unusually extensive and varied, and he had the happiness of witnessing in his sons the successful cultivation of those studies which other and more absorbing duties had compelled him to abandon. Mr. Lushington was a man of a cheerful temper, of very courteous and pleasing manners, temperate and tolerant in all his opinions, and exemplary in the discharge both of his public and private duties: few persons have ever been more sincerely beloved either by their friends or by the members of their families.

Mr. George Saunders was formerly architect to the British Museum, where he built the Townley Gallery; he was a diligent and learned antiquary, and the author of a very interesting and valuable paper in the twenty-sixth volume of the Archæologia, containing the results of an inquiry concerning the condition and extent of the city of Westminster at various periods of our history.

The only foreign members whom the Royal Society has lost during the last year are the Baron de Prony, one of the most distinguished engineers and mathematicians of the age; and the venerable Pierre Prevost, formerly Professor of Natural Philosophy in the University of Geneva.

Gaspard Clair François Marie Riche de Prony, was born in the department of the Rhone, in 1755, and became a pupil at an early age, of the Ecole des Ponts et Chaussèes, where he pursued his mathematical and other studies with great application, and with more than common success. He was subsequently employed as an adjunct of M. Perronet, the chief of that school, in many important works, and particularly in the restoration of the Port of Dunkirk; and in 1786, he drew up the engineering plan for the erection of the Pont, Louis XVI., and was employed in superintending its execution. M. de Prony had already appeared before the public, first as the translator of General Roy's "Account of the Methods employed for the Measurement of the Base on Hounslow Heath," which was the basis of the most considerable geodesical operation which had at that time been undertaken; and subsequently as the author of an essay of considerable merit, "On the Construction of Intermediate Equations of the Second Degree." In 1790 and 1797, appeared his great work in two large volumes, entitled *Nouvelle Architecture Hydraulique*, which is a very complete and systematic treatise on Mechanics, Hydrostatics and Hydraulics, and more particularly on the principles of the steam-engine and hydraulical engineering. In 1792 he was appointed to superintend the Cadastre or great territorial and numerical survey of France—a gigantic undertaking, the subsequent execution of which, during the revolutionary government, combined with the establishment of the bases of the decimal metrical system, gave employment and developement to so many and such important scientific labours and discoveries; among many other laborious duties the formation of the extensive tables devolved upon M. de Prony, who, in the course of two years organized and instructed a numerous body of calculators, and completed the immense *Tables du Cadastre*, which are still preserved in MSS. at the library of the Observatory in seventeen enormous folio volumes. M. de Prony became Directeur-General des Ponts et Chausseés in 1794, and was nominated the first Professor of Mechanics to the Ecole Polytechnique—an appointment which led to the publication of many very important memoirs on mechanical and hydraulical subjects, and on various problems of engineering, which appeared in the Journal of that celebrated school. He declined the invitation of Napoleon to become a member of the Institute of Egypt—a refusal which was never entirely forgotten or pardoned. In the beginning of the present century he was engaged in execution of very extensive works connected with the embankments towards the embouchure of the Po, and in the ports of Genoa, Ancona, Pola, Venice, and the Gulf of Spezzia; and in 1810, he was appointed in conjunction with the celebrated Count Fossombroni, of Florence, the head of the *Commissione de l'Agro Romano*, for the more effectual drainage and improvement of the Pontine Mashes. The result of his labours in this very important task, which he prosecuted with extraordinary zeal and success, was embodied in his *Déscription Hydrographique et Historique des Marais Pontins*, which appeared in 1822, which contains a very detailed description of the past, present and prospective conditions of these pestilential regions, and a very elaborate scientific discussion of the general principles which should guide us, in this and all similar cases, in effecting their permanent restoration to healthiness and fertility. After the return of the Bourbons, M. de Prony continued to be employed in various important works, and more particularly in the formation of some extensive embankments towards the mouth of the Rhone. In 1817 he was made a member of the *Bureau des Longitudes*, and in the following year he was elected one of the fifty foreign members of the Royal Society: in 1828 he was created a Baron by Charles X., and was made a peer of France in 1835. He died in great tranquillity at Aonières, near Paris, in July last, in the 84th year of his age. The Baron de Prony was a man of singularly pleasing manners, of very lively conversation, and great evenness of temper. He was one of the most voluminous writers of his age, generally upon mathematical and other subjects connected with his professional pursuits; and though we should not be justified in placing him on the same level with some of the great men with whom he was associated for so many years of his life, yet he is one of those of whom his country may be justly proud, whether we consider the extent and character of his scientific attainments, or the great variety of important practical and useful labours in which his life was spent.

Pierre Prevost was born in 1751, and was originally destined to follow the profession of his father, who was one of the pastors of Geneva. At the age of twenty, however, he abandoned the study of theology for that of law, the steady pursuit of which, in time, gave way to his ardent passion for literature and philosophy: at the age of twenty-two he became private tutor in a Dutch family, and afterwards accepted a similar situation in the family of M. Delesert, first at Lyons, and afterwards at Paris. It was in this latter city that he commenced the publication of his translation of Euripides, beginning with the tragedy of Orestes—a work which made him advantageously known to some of the leading men in that great metropolis of literature, and led to his appointment, in 1780, to the professorship of philosophy in the college of Nobles, and also to a place in the Academy of Berlin, on the invitation of Frederick the Great. Being thus established in a position where the cultivation of literature and philosophy became as much a professional duty as the natural accomplishment of his own wishes and tastes, he commenced a life of more than ordinary literary activity and productiveness. He died on the 8th of April, in the 88th year of his age, surrounded by his family, and deeply regretted by all who knew him.

Use of Varnish of Dextrine in the Fine Arts.—In the sitting of the Academy of Sciences, Monday, 26th August, Baron De Silvestre made the following remarks on the occasion of M. Arago's communication on the preservation of photographic images. He observed that it would be interesting to try dextrine for this purpose, as he himself, for more than two years, had successfully used this substance for varnishing pictures newly painted in oil, water colour drawing, coloured lithographs, and for the permanent fixation of pencil drawings. He had also obtained from dextrine a glue, which he found superseded with advantages all other gluey substances, and particularly mouth glue. In these different applications dextrine is mixed with water in different proportions; two parts to six of water for varnish, and in equal parts for glue. He observed that he always added one part of alcohol in the composition of the varnish, and half a part in that of the glue. The mixture should be always filtered before being used for varnishing pictures and fixing drawings, and in this latter case, a fine wet muslin should be spread over the drawing, before covering it with the mixture of filtered dextrine. The description of these processes, and of the results obtained, is given in the *Bulletin de la Societé d'Encouragement pour l'Industrie Nationale*, for the 2nd of August, 1837.

ANTIQUITIES OF THE CITY OF LONDON.

Sir—Having been called in by the Rector of *Saint Mary Aldermary and Saint Thomas the Apostle*, to inspect the North Wall of the Church of Saint Mary Aldermary, Watling-street, I was led to the following conclusion, after a most careful examination, as to the antiquity of portions of that wall, which may prove interesting to many of your readers.

In rebuilding the church after the memorable fire of London, it seems that Sir Christopher Wren not only retained the original line of the north wall, but finding it unnecessary to pull it down entirely, left it untouched as far up as a string-course which formerly ran along the whole length of the church, under the sills of the windows of the north aisle, traces of it being perfectly discernible to an eye familiar with the remains of antiquity, from the north-east angle of the building to the north doorway. There are also remains of the original basement-moulding, and the original buttresses still exist with the stringcourse profiled round them, they are five in number, and, in one or two places, the face of their ashlar is as perfect as when first worked. The original ashlar of the whole of this wall still remains from the level of the ground to that of the string-course before mentioned, and indeed a small portion of it is left some five or six feet above the string-course, immediately adjoining the easternmost buttress. The rebuilding is clearly defined by the rough masonry of this wall above the level of the string-course, which seems to have been intended at the time as a party-wall between the church and the glebe-houses, not only on account of its not being faced, but also on account of the entire absence of openings for light. The north doorway, with its discharging arch in rough masonry is evidently an insertion in the original wall, the recesses over the doorway seem to have been left as cupboards for the adjoining house, as the masonry of their arches is coeval with that of the discharging arch over the doorway. Before the fire, I have no doubt, this wall was quite unincumbered by buildings, first, because the ashlar still remaining shows a fair face; secondly, because the buttresses still exist, showing also a fair face; and thirdly, because remains of the basement-moulding and the string-course, both being exterior features, can be clearly pointed out. There must therefore have been a space, originally, between the church and the glebe, which seems to have been used as a burial-place, as human bones were some years ago found near the footing of this wall. This space, on account of Watling-street having been either widened at the time or removed farther southwards, (242½ feet were cut off from the glebe land in front towards the street, see Oliver's Survey, vol. 2, p. 155,) was, by the Decrees of the Judges, made part and parcel of the glebe; and this accounts satisfactorily for that wall having been, in the rebuilding, made a party-wall, and also for the right of way having been reserved to the parishioners from the street, through the glebe, up to the north doorway of the church.

I have made a careful drawing of these remains, which I shall be most happy to show to any one who, like myself, may take an interest in old gothic buildings.

Your's, &c.,
Thos. E. Walker.

2, *Keppel-street, Russell-square, Dec.* 3, 1839.

ISLE OF SHEPPY.

Sir—Having read an extract from the Cinque Ports Chronicle in this month's journal, on "The Encroachments and Recessions of the Sea," in which the only reason assigned for the former is the action of the sea in its ceaseless beatings against the shore; I am induced to bring to your notice the Isle of Sheppy, where from another cause the sea is making a more rapid encroachment than perhaps any other part of England: so much so, that I think in a very few years the greater part of Minster Hill, the Station Houses at East End Lane, and Hensbroche will be swallowed up by the sea. Indeed the extent of bank left at low water, particularly during spring tides, and the very great distance from the beach that the stone for cement is dug up, (I *believe* the Rudis Helmontia) prove that the island was once of much greater extent than at present, and from my observation of the land slips that have taken place since I came here in June last, I should certainly say they were caused by underground springs endeavouring to find an outlet, and that by proper drainage much valuable land might be saved. Indeed the shelving beach or strand caused by the former destruction of the island is now a strong natural protection to it, and that the present almost daily loss is owing to want of care in directing the numerous springs into a proper channel.

I am, Sir, your obedient servant,
C. F. Parkinson.
Captain 73rd Regiment.

STEAM BOAT PROPELLERS.

Experiments by George Rennie, Esq., communicated to the Editor of the Railway Magazine.

I herewith send you the average result of a series of experiments I have made on the comparative merits of several instruments which have been tried for propelling vessels through water, under similar circumstances. In order, therefore, to arrive at this knowledge, three different sets of experiments were tried: first, on a model wheel, of two feet in diameter, fixed in a trough of water, and moved by a weight falling through equal height; secondly, by means of a boat to which the different kinds of propeller were adapted, so as to render the circumstances similar in every respect; thirdly, by means of a small steamer, of moderate dimensions, so as to enable the experiments to be made in still water, and thus obtain more accurate results than could possibly be obtained in a tidal river like the Thames. The following are the results on the model—

No. of Experiments.	Diameter of wheel.	Time in seconds.	Area of floats immersed.	Weight suspended.	Area of one float.	
6	2 ft.	15·5	12 in.	4 lbs.	6 in.	Rectangular floats.
6	2 ft.	15·1	9 in.	4 lbs.	3 in.	Trapezium floats.

An experiment was then tried by immersing the rectangular floats to twice their depth. The result was to increase the time of the 4lb. weight falling to 32 seconds, or double the resistance when immersed to the ordinary depth of the float, while the trapezium-shaped float, doubly immersed, only required 16 seconds for the 4lb. weight to fall through the same space; thus, proving the great defect of the paddle-wheel, as applied to all sea-going steam-vessels, so that when deeply laden with coals at the first part of their voyages, the engines can only make half their proper number of strokes. The British Queen, for instance, the engines of which are frequently reduced to nine, instead of seventeen or eighteen, the full number of strokes. These experiments have been repeated again and again, before competent witnesses, and always with the same results.

Secondly—with different kinds of propellers attached to the same boat.

The following are the comparative results:—

Table in which are compared the Performances of the Screw-Propeller, Conoidal-Propeller, and Paddle-wheels.

Distance travelled in feet.	Time in seconds.	Revolution of winch.	Revolution of winch p. min.	Speed of boat in miles p. hour.	Conditions of Experiment.
660	201·0	140·7	42·0	2·2	Screw Propeller, 17 in. diameter, 226 ins. area; revolved with a velocity five times that of the winch.
660	155·25	108·25	41·8	2·8	Paddle-wheel with 12 rectangular floats, each float 9½ × 4; area of floats immersed 228·8 ins.; extreme diameter of wheel, 3 ft. 3 in.
660	155·75	120·75	46·5	2·8	Paddle-wheel, with 12 trapezium-shaped floats (*obtuse* ends down), each float 9½ × 4; area of floats immersed, 103 ins.; extreme diameter of wheel, 3 ft. 6½ ins.
660	153·5	121·75	47·5	·9	Paddle-wheel, with 12 trapezium-shaped floats (*acute* ends down), each float 9½ × 4; area of floats immersed, 107 ins.; extreme diameter of wheel, 3 ft. 10¾ ins.
660	135·5	89·6	39·6	3·3	Conoidal propellers, 17 ins. diameter; 144 ins. area; revolved with a velocity five times that of the winch.

N.B.—The above experiments were made with a boat such as is used in the whale fishery; its length was 27 feet, its breadth 5 feet, its depth 2 feet 1 inch, and its weight, with ballast and persons on board, 2828 lbs., the area of its midship section 483· square inches. In each experiment the winch was driven by two men.

Conclusions.—From the preceding table it appears that the relative merits of the screw propeller, the conoidal propeller, and the common and trapezium-shaped floats are precisely in the order in which they stand in the table; that the screw is inferior to the common paddle-wheel in the ratio of 2·2 to 2·8, with the spear-pointed paddles as 2·2 to 2·9, and with the conoidal propeller as 2·2 to 3·3; that of the trapezium-shaped floats as 2·8 to 2·9, and that with the obtuse angle down is equal. It may be objected to these experiments, that the boat being worked by men, the results cannot be depended upon, on account of the irregular, and, perhaps, over-zealous action of animal power. But, after a few trials, the action soon becomes as regular, and may be calculated upon with nearly the same accuracy, as a steam-engine.

Thirdly—By means of a steam-boat. This boat was kindly lent by the London and Westminster Steam-boat Company; and is of the following dimensions:—

Length.......................... 57 feet.
Breadth .... 6 feet.
Depth .... 3 feet.
Power—two engines (vibrating) of 5 horse power—36 strokes per minute.

Table in which are compared the Performances of Rectangular and Spear-shaped Floats, with the "Pink" steamer, in the West India Import Dock, in November, 1839.

Distance travelled in feet.	Time in seconds.	Revolutions of cranked shaft.	Revolutions of cranked shaft per. min.	Speed of boat in miles p. hour.	Conditions of Experiments.
1320	138·	84·0	36·5	6·7	Wheels fitted with 10 rectangular floats 23 × 9 ins. = 207 s. ins.; area of floats immersed, 635·6 s. ins.; extreme diameter of wheel, 7 4.
1320	145·75	87·5	36·0	6·34	Wheels fitted with 10 trapezium-shaped floats (*acute* and *down*), 18 × 11½ = 103·5 s. ins.; area of floats immersed 432·25 ins.; extreme diameter of wheel, 8 10.

Conclusions.—From the results of these experiments we are justified in concluding that the trapezium-shaped float, containing only one-half of the surface of the common paddle; and one-third of its width, will have equal hold of the water, and propel the vessel equally as fast, with a less expenditure of power; but its properties are not only confined to this.

In the first place, they are less weight and first cost, by at least one-half.

Secondly—They present less surface the wind, particularly against a head-wind.

Thirdly—They enter the water without the shock and vibrations which are experienced with the common wheel, and without raising the cascade of water appertaining to the old form of paddle.

Fourthly—They work nearly as well when deeply immersed, with the exception of the slight resistance arising from the edges of the arms.

All which properties have been witnessed and tested by competent judges.

GAS PRODUCED BY A NEW PROCESS.

An experiment in gas-lighting by the Comte de Val Marino was made on Thursday evening on a piece of waste ground at the back of Fetter-lane, in the presence of several scientific gentlemen, who were invited to witness the result. A small gasometer was erected for the purpose, which was connected by tubes with a furnace built of brick, and containing three retorts, one of which was supplied with water from a siphon, another was filled with tar, and both being decomposed in the third retort, formed the sole materials by which the gas was produced. The process appeared to be extremely simple, and the novelty of the experiment consisted in the fact, that the principal agent employed to produce the gas was common water combined with tar; but, according to the theory of the inventor of this new species of gas, any sort of bituminous or fatty matter would answer the purpose equally as well as pitch or tar. After the lapse of about half an hour employed in the experiment, during which time the process was explained to the company, the gas was turned into the burners, and a pure and powerful light was produced, perfectly free from smoke or any unpleasant smell. The purity and intenseness of the flame were tested in a very satisfactory manner, and those who witnessed the experiment appeared perfectly satisfied with the result. The great advantage of this sort of gas over that produced from coal consists, it was said, in the cheapness of the materials employed in its production, the facility with which it is manufactured, and the perfection to which it is at once brought, without the necessity of its undergoing the tedious and expensive process of condensation and purification; for in this instance, as soon as the preliminaries were completed, the light was produced in a perfect state within a few feet of the gasometer, which, although of inferior size, was said to be capable of affording light for 10 hours to at least 500 lamps or burners. With regard to the comparative expense, it was also stated that 1000 cubic feet of gas manufactured by this process, could be supplied to the public for about one third the price now charged by the coal-gas companies; and it was said to be equally available for domestic use, and more safe than the common gas, inasmuch as small gasometers might, at a trifling expense, be fixed at the back of grates in private dwellings, from which the gas could be conveyed in India-rubber bags to any part of the house, thereby preventing the many accidents which occur by the use of tubes and pipes. The Count de Val Marino, who has conquered the difficulty hitherto experienced in bringing this species of gas into use, superintended the arrangements, and evinced a natural anxiety to bring his experiment to a successful issue. He has taken out a patent for his discovery, and he has improved upon the burners now in use, so as to render the light produced more pure and intense. For this improvement he is also secured by a patent. How far gas of this description can be brought into general use, or whether in point of economy the public would be benefited by its adoption, are questions which we have not the means of deciding, and, without hazarding any opinion on the subject, we can only say that the experiment, as far as it was tried in this instance, appeared to be quite successful.—*Times.*

AMERICAN PATENTS.

(From the Journal of the Franklin Institute.)

For "*An improved Eccentric Brake, for arresting the motion of Railroad Cars.*" Ephraim Morris, Bloomfield, Essex county, New Jersey, Sept. 19.

Between the two wheels on each side of a car there is to be a cam wheel, one part of which is to be a segment of a circle, resembling the periphery of one of the wheels; another portion of the periphery of the cam is in a straight line, probably of two feet or more in length, and the cam may be made to roll round on its circular, or curved part, and to bring this straight part upon the rail, which, whilst it bears upon it, will lift the wheels, at one or both ends, therefrom. The straight portion of the cams are furnished with flanches which embrace the rail. This part, by its friction upon the rail, is to operate as a brake upon an inclined plane, or elsewhere. The claim is to the foregoing arrangement of the respective parts.

When it is desired to relieve the brake, this is effected by backing the cars, when the ordinary wheels are made to rest upon the rail, the lower side of the brake being then free from them; there are, of course, some particular devices described which we have not noticed, nor do we think it necessary, being apprehensive that the contrivance is not destined to be adopted.

For "*A Machine for cutting the Teeth of Circular Saws.*" Thaddeus Sellick, Haverstraw, Rockland county, New York, September 19.

One, two, or more, steel plates, prepared to have teeth cut upon them, are to be placed upon a vertical spindle capable of revolving on its two ends. These plates are to be made to bear against a revolving cutter, consisting of an endless screw, the thread of which is in such form as to cut a saw tooth. A cutter two inches in diameter and half an inch in thickness, has been used for the purpose. The revolution of the cutter will cause that of the saw plates, which are borne up against it. It is remarked that the teeth of straight saws may be cut by a similar device.

"What I claim, is the employment of a circular revolving cutter, having a thread or channel on its periphery, running in the manner of an endless screw, and so arranged and combined with the other parts of the machinery employed, as to cause the cutter to cut, and to feed the plates to itself, by its own action, the whole operating substantially in the manner above set forth."

For "*An Improvement in the mode of preserving Timber.*" Edward Earl, Savannah, Georgia, September 20.

We published in our last number, the specification of a patent for a similar purpose, the gentleman above named being one of the patentees. The mode of procedure in the present case is like that described in the former patent; that is, the timber is to be boiled in the solution by which the preservative quality is to be communicated, which solution is to consist of sulphate of copper, (blue vitriol,) and sulphate of iron, (copperas,) dissolved in water. One part of sulphate of copper to three of sulphate of iron, are to be taken, and about three pounds of the mixed salts added to every gallon of water. The timber after being bored through its length, is to be boiled, and afterwards suffered to cool in this solution. The claims made, are to "the boiling of timber as described, in a solution of sulphates of iron and of copper; applying this solution to the interior as well as the exterior of the timber, by means of the central perforation when the size of the timber requires it, as the most effectual mode of protecting it from the ravages of insects, and of rot. I do not claim the saturating of timber by a solution of sulphates in water when applied cold, but confine my claim to boiling it, as above set forth, in that solution, during from two to five or six hours, or more."

For "*A Gravel Pump.*" Laura Rice, administratrix of J. J. Rice, and Ebenezer Rice, Salina, New York, August 15.

"This pump, or machine, is inserted in a well, or shaft, which should be properly tubed with cast or sheet iron, or other proper material, with space to permit it to pass readily, and having a rope, or cords, connected with the end of the piston, is worked in the manner of a pump until sufficiently charged with the substance to be removed, when it is raised by a windlass, or other power. It is particularly adapted to the excavations of shafts for brine, and was discovered whilst excavating wells for that purpose, as no instrument was known which would readily raise the gravel from the beds without great delay and difficulty, and at the same time leave the sides of the well bare and pervious to the transmission of brine, the ordinary process of drilling merely crowding the staves from the shaft, and rendering the sides of the well compact, hard, and nearly excluding the passage of small streams of brine into the well."

The form of the exterior of the machine is that of two cylinders differing in size, the smaller standing above the larger; the lower cylinder is to be about 11 or 12 inches in diameter, and 21 in height; the upper one may be 8½ inches in diameter, and 15 in height; they are connected by an offset, are hollow, and made of cast iron; the upper cylinder forms a pump chamber in which a piston is to work. The lower cylinder constitutes a receiver to retain the sand and gravel drawn into it by the action of the pump. In the bottom of the lower cylinder there is a round opening of six inches in diameter, and the upper and inner edge of this opening is surrounded by pieces of whalebone, or other elastic material, which rise from it so as to form a cone somewhat like that of the pointed converging wires in some rat traps; these may be six or seven inches long. They allow of the passage of stones and gravel into the chamber, and prevent their return. This elastic material is surrounded by a sleeve of cloth, which admits sand to pass up and around it.

The claim is to "the manner of connecting and combining the respective parts of the above described machine, for the purpose of excavating wells and shafts, and the removal of sand and gravel therefrom; that is to say, the combination of the exhausting apparatus with the cylinder, the conical bars of whalebone or other material, and the canvas surrounding the same, constructed and operating in the manner set forth."

PRESERVING TIMBER BY LIME WATER.

Specification of a Patent for an improvement in the mode of preserving Timber. Granted to Samuel Ringgold, of Florida, and Edward Earle, of Savannah, State of Georgia, Aug. 6, 1838.

(From the Franklin Journal.)

The nature of our invention consists in applying heat, by boiling in strong lime-water, to the interior as well as to the exterior of timber, according to the size and kind of timber, and the use in which it is to be employed may admit, or require, for the destruction and prevention of worms in it, and for the correction or removal of the corruptible sap, and the occupation of its place by a preservative substance.

We first bore the timber, if it be of a size sufficient to admit of it, through the centre, making the perforation of a calibre proportioned to the size of the piece, say from half an inch to an inch and a half, or two inches. Then we boil it in strong lime water for a length of time proportioned to its size, as four to six hours, if it be twelve inches square, and so in proportion to its substance; and when the timber has had the heat and fluid conveyed through its whole substance, it is to be removed to a shed, where, protected from the sun and wind, it may gradually dry. Finally, before it is used, the perforation through the centre is to be completely filled with dry lime, or with petroleum, or coal tar, as the purpose for which it is intended may make preferable, and plugged by wood of the same kind, and prepared in the same manner. Also, if the use to which the timber is destined be such as to admit of it, the exterior may be payed, or coated with hot petroleum, or coal tar.

What we claim as our invention, and desire to secure by letters patent, is the boiling of timber in lime water, as above set forth. We apply the fluid to the interior as well as exterior of the timber, by means of the central perforation, when the size of the timber requires it, as the most effectual mode of preserving it from the ravages of insects, and from rot. We do not claim the saturating of timber by a solution of lime in water when applied cold, or when heated by that heat which is generated in the slacking of the lime, but confine our claim to the boiling it in lime water during one, two, three, or more hours.

Remarks by the Editor.—The plan of impregnating timber with lime, by soaking it in lime water, is quite old, but we have never yet seen any evidence of its utility. This is an assumed effect, but one which, we believe, yet remains to be proved. The only substantial difference in the plan above proposed, and that formerly assayed, is in the boiling process, and this we think of a very doubtful utility. Timber may be rapidly seasoned by boiling, the moisture within it being converted into vapour, and consequently escaping through the pores, a condition not the most favourable to the entrance of a solution; the allowing it to cool in and with the liquor, might probably promote saturation. There is another fact of some importance in the process, provided the thing itself is of any value, namely, that the colder the water the greater is the quantity of lime held in solution, and of course more would enter the pores in a cold than in a heated vessel. It is not worth while, however, to extend our speculations upon the best mode of getting the lime in until we have ascertained the fact that when it is there it will produce some good result.

HER MAJESTY'S DOCK-YARD, WOOLWICH.

Extensive works are at present in operation at the west end of the yard, for the formation of a large graving dock, which is to afford accommodation to the first class government steamers. The site for the new dock, is the south side of the basin or wet dock, which is principally used for fitting out steamers; the situation thus chosen allows of room for another dock of like dimensions being constructed to the eastward of it, in the event of such extended accommodation being required. The works, which are contracted for, and being executed by, Messrs. Grissell and Peto, under the direction of Mr. Walker, the engineer, are of great magnitude, comprising likewise the formation of a wall across the entrance to the old concrete dock, which was undertaken by Mr. Ranger, and constructed of his patent concrete; this material was not found sufficient to keep down the land springs, and has, consequently, been relinquished. For the formation of the new dock, a cofferdam has been constructed in front of the proposed entrance, nearly a hundred feet in length, consisting of parallel rows of close piling driven into the solid ground, as that portion of the basin wall within the cofferdam will necessarily have to be removed, great strength is required in the framing of the timbers for its support, which appears to have been amply provided for by the excellent arrangement of shoring adopted. Considerable progress has been made with the excavation for the dock, which has been taken out for nearly its entire surface, to a depth of from twenty to thirty feet below the quay level; to prevent the slopes of the excavation from slipping, and likewise to save room, the whole area of the dock is being enclosed with sheet piling, which, as the masonry of the side walls advances, will be removed if found advisable. The dock will be constructed of granite, either from the New Granite Co.'s quarries, near Plymouth, or from the Haytor quarries in Devonshire. A large quantity of stone is now upon the ground partly worked. The length of the dock will be 265 feet from the semicircular head to the inside of the gates, the width at top 80 feet and at bottom 37 feet, the clear width at the entrance 65 feet, the depth 26 feet from the quay level to the invert, being equal to 22 feet depth of water at high water, Trinity standard; the entrance gates and plan of working them will be according to the most approved construction.

The sides of the dock will be formed in steps or altars, varying in height from nine to sixteen inches, and in width from nine to fifteen inches, with the exception of one called the Broad Altar, about midway down which will be eighteen inches in width; the object of these altars is for the convenience of placing the shores against the hull of a vessel at any height, and for resting the ends of spars for staging; that called the Broad Altar is made wider than the others, for walking upon in examining the sides of the vessel under repair; the curve given to the altars is calculated to suit nearly the form of a vessel, and likewise affords, as before stated, the opportunity of shoring at any height, which is precluded by the common form of docks where very deep altars are used, and they will also enable the workmen to get up and down at any part of the dock with great facility, but for general purposes, a staircase of more easy ascent will be constructed at the head of the dock; slips for letting down and raising timber, &c., will be formed at the head, and likewise on each side of the dock. The stones of the invert forming the bottom of the dock will radiate, as likewise the altar stones as high as the Broad Altar, the whole thus forming an arch to resist the upward pressure, and the masonry above, as likewise the coping, will be in stones of large dimensions, the whole backed with brickwork and concrete. The walls at top will be four feet thick, and at bottom 25 feet 6 inches, and the total width of the foundations will be 88 feet, under which a body of concrete three yards thick will be carried down to the gravel. The apron at the entrance will be supported upon bearing piles, and protected in front with sheet piling made water-tight. As an engine and pumps will be required for emptying the dock, a pumping engine is now being constructed by Messrs. Bolton and Watt, and will be fixed ready for working by the time the dock is finished, Large brick culverts, furnished with proper penstocks, will be formed for drainage to the engine-well, and also for filling the dock when required for floating a vessel out. During the works, the large area excavated for the dock will be kept clear of water by a temporary engine and pumps, which are in course of erection. From the above some idea may be formed of the magnitude and importance of the works now in progress at Woolwich Dock Yard, which, with other improvements now being executed under the direction of Captain Brandreth and Lieut. Dennison, of which we hope shortly to give an account, will render this yard a very complete establishment for that important department of Her Majesty's navy, the steam marine. We will endeavour, at some future opportunity, to give further particulars of these interesting works during their progress.

Peterboro'.—The Justices for this liberty, at their meeting on Saturday the 30th ult., adopted the plans of Mr. Dunthorne, of Hanover-street, London, for the new gaol about to be erected for this liberty. Many very meritorious plans were sent for the inspection of the Justices: and amongst them, those of Mr. Sibley, of Great Ormond-street, and Mr. Alexander, of Adam-street, Adelphi, London, and of Mr. Walter, of Cambridge, elicited the greatest approbation. Mr. Blore, who is erroneously stated by a cotemporary to have been the successful candidate, did not send in a design.—*Stamford Mercury.*

ON THE POWER OF THE STEAM ENGINE.

At the last meeting of the Cornwall Polytechnic Society, held at Falmouth, Mr. Snow Harris read an abstract of an interesting and valuable paper on the Steam-engine, by Professor Moseley, he passed a high eulogium on that gentleman whose paper, he said, possessed a great deal of interest to the working engineer and practical miner. The details of the paper would, however, be too tedious to bring before a mixed audience, and he had therefore abstracted the principal points which it was necessary to bring under their considertion. Professor Moseley appeared to think that the efficiency of a steam engine could be measured only by observations of the cylinder itself, because the estimate at any other place was less than the actual deficiency on account of friction and other causes. Hence they could not tell *à priori* of what the engine was capable. If they had a good measurement of the efficiency at the cylinder, and also of the work actually performed, they should then arrive at a true estimate of the power of the engine, and also of the loss by friction, &c., by subtracting one from the other. In the Cornish engines they had already the efficiency of the working parts; they required, therefore, the only observations at the cylinder. It was the difference of these which was the efficiency for the pit work, and of so much importance to the adventurer and engineer. Professor Moseley proposed to arrive at the efficiency of the cylinder by connecting a second smaller cylinder with it of about six inches diameter, so as to allow of the steam acting upon a spring through the medium of a solid plug in the latter. The writer thought the effective pressure upon this plug as indicated by the quantitatum measurement by means of the steel spring will be always equal to that upon an equal area of the piston of the engine; so that knowing one of these pressures they could always determine the other—namely, the effective pressure. The author proceeded to explain by diagrams a practical method of carrying out his general principle. He further thought that they not only wanted to know the effective pressure throughout the whole duration of the stroke, but also how much of the stroke was described under any given pressure. The author furnished methods for arriving at this important element which were well worthy of attention, and were such as to apply either to a long period as a month, or a short period of six hours. The Professor considered that the *out* as well as the *in* stroke should be registered, and he gave an arrangement for the purpose, and the results were registered upon indicator diagrams, different from those of Watt, and upon an area sixty times as great. There seemed but little doubt that the author of this paper, which must be considered as an extremely important one to the practical miner and engineer, had succeeded in inventing methods for arriving at the efficient power of the steam engine. It was the mechanical details which required consideration. They must obtain very perfect springs calculated to yield through spaces proportioned to the pressures. This was a vital affair, for should not such be the case the indications would be erroneous. The author thought that this property could be given to spiral springs, as well as to bow springs of a given form; and that with due correction for the friction of the small cylinder, the method might be made practically perfect. Mr. Jordan, with his usual ability, had given a drawing of the indicator, and had contributed largely to its mechanical advancement. Professor Moseley proposed to call this instrument the *pit work* counter, because it indicates, by comparison with the counter in present use, the amount of the pit work. Mr. Harris concluded by observing that this was a brief abstract of the very valuable paper furnished by Professor Moseley, and he was only sorry that the time allowed him had not permitted him to do Professor Moseley more justice than he had on the present occasion.

Steam Apparatus.—There is in the Oxford Union workhouse a steam apparatus by means of which the whole of the clothing and other articles used in it are washed, dried, and ironed, in an incredibly short space of time. We have lately been afforded an opportunity of witnessing this useful piece of mechanism in operation, on which occasion no less than 1235 articles of wearing apparel, bed-clothing, &c., were washed, dried, and ironed, in two days, with the assistance of only eight women and two girls from the school. It is the invention of James Wapshare, Esq., of Bath, for which we understand he has obtained a patent, and was some time since erected in one of the wings of the building solely devoted to the purposes of a laundry, at the expense of the chairman of the Board, the Rev. N. Dodson. The apparatus consists of a small steam boiler, with two pipes for the conveyance of steam. By the one pipe the steam is conducted to the coppers used for boiling the clothes and supplying the washers with hot water, by the other the steam is carried to a closet in which the linen is to be dried. The exterior of this closet is a wooden frame covered with zinc, within it is fitted up with pipes, increasing in number according to the extent of drying power required. These pipes are arranged horizontally one above another, resembling a turnpike gate; excepting that the rails are connected at one end only by a bend or turn, thus forming a continued duct for the steam. The steam is admitted at the upper pipe, and passes its condensed water at the lowest. On either side of this tier of pipes is a movable clothes horse, which is drawn out to be hung with clothes. Upon the construction of these horses the operation of drying in a great measure depends. They are made close at the top of the box, so that no heat may escape over them, and the clothes are so disposed on them as to form an entire sheet, completely enclosing the pipes, and preventing any escape of the heat radiating from the pipes, except by passing through the clothes to be dried. This disposition of the clothes is easily accomplished, but difficult of description. On the outside of the horses, or on that side which is not next the pipes, a valve or opening is made on the top of the box, and a current of air being admitted at the bottom, the steam from the clothes is carried off as fast as it is generated. One set of these pipes, with two horses, would be sufficient for any moderate family. In an establishment so extensive as an Union house more is required. In the closet erected are three ranges of pipes, and consequently six horses or two to each range, having an air space, with its valve between each set of horses. Attached to the flue that surrounds the boiler is a small oven for heating the irons, so that the whole operation of the laundry, as far as heat is required, is simultaneously effected by one fire.—*Oxford Herald.* [We insert this notice, not for its novelty, but for its utility, and to show the application of steam to domestic purposes, in the erection of extensive buildings intended to contain a large number of inmates. We cannot, from the above description, ascertain what claim Mr. Wapshare can have for a patent, as similar arrangements have been adopted many years past.—Ed. C. E. & A. Jour.]

Harbour Crane.—A crane capable of raising great weights at the harbour having been found indispensable, a considerable time since, Mr. Leslie, engineer to the harbour, executed a plan for a machine capable of raising thirty tons. The merit of the design has been very extensively acknowledged among professional men, and those who are initiated in mechanics. Mr. Peter Borrie, the contractor for the work, has been engaged for some time past in casting the different parts of the crane. The novelty of the design, and the magnitude of the work, evince the skill and attention which must have been bestowed upon its completion. The gross weight of the post, including the back and side tension-bars, friction collar, hoops, &c., is no less than twenty-five tons, or within ten tons of the weight which it is intended to lift. The pedestal for this crane is a beautiful piece of masonry; and rising considerably above the quay, it was necessary to raise the post to an elevation of fifty-five feet before it could be put into its place. This was done by two tackles and crab windlasses of great power—the upper blocks being fastened, at a height of sixty feet, to the apex of three shear poles. The whole time occupied in the transit of the axle pole, and in raising and lowering it into the cast-iron cylinders, did not exceed six consecutive hours. Ten men were found adequate to perform the whole operation of raising and lowering the post, and adjusting it to its proper position in the cast-iron cylinder. The extreme length of the post over all is nearly forty-five feet. As the crane is not yet completed, we cannot speak of it as a whole; but there cannot be a doubt that it will be a great advantage to the large class of steamers, especially to our yet unrivalled London steamers. And we understand that as soon as it is ready, and disengaged (for the steamer Perth has secured the first turn), a very large steamer from a distance is to be brought to Dundee in order to get in new boilers. In this way, we have no doubt, an ample recompense will be obtained for the great accommodation now to be given for the shipping at the port. Much work, and a considerable amount of shore-dues, may, in consequence of the facilities afforded by the crane, be brought to Dundee, which otherwise would have been lost to it. The testing of this vast machine will be a process of some interest; and we have no doubt the successful result will add to the well earned reputation of Mr. Leslie; and be highly creditable to Mr. Borrie, by whom the work has been executed.—*Dundee Courier.*

Seguin's Animal Gas Apparatus.—In a memoir on the compression of gases, and on the reduction of variable pressures into regular pressure, M. Seguin gives the Academy of Sciences a description of a new pump, with a regulating apparatus, for the compression of gas for illumination obtained from the distillation of animal substances. The pump is so arranged as to give the maximum force at the moment of the course when the gas presents the maximum of resistance by the diminution of its volume; to work in a vertical position without loss of gas, and without the piston being immersed in fluid; and lastly to avoid, by means of a particular mode of transmitting power, the use of guides, which would cause a friction in the piston-rod.

Artesian Wells.—M. Viollet has communicated to the Academy of Sciences the results of the experiments which he has made at Tours, to ascertain the quantity of water supplied by an Artesian well, after some repairs undertaken for the purpose of remedying a considerable diminution which took place in the produce. The repairs executed under the direction of M. Mullot had complete success, and the well now serves to supply motive power for the silk mill of M. Champoiseau. The well, which in July, 1834, immediately after its completion, only supplied 1600 litres per minute to the surface, has since given the following results ascertained by gauging kept up from the 15th to the 23rd of May last.

0·50 metres above the surface	3480 litres per minute.
4·75 . . .	1620
5·75 . . .	1140

The well having been put into action, and supplying its water from the 23rd of May from a new orifice, situated 5 metres above the surface, I found by gauging, on the 2nd of August, a produce of 1702 litres per minute, instead of the 1620 only, which the orifice at 4·75 metres gave in the 23rd of May. The produce has, since then, still further increased, which progressive increase is attributed by M. Viollet to the alimentary channels being cleared by the rejection of the sand brought to the surface by the water of the well; but it is important, as it leads to the hope that the unfortunate diminution of supply will not again occur. [We cannot entertain the confidence of M. Viollet, but must feel, to some extent, distrustful of wells sunk in sandy strata, which are exposed to many inconveniences.—Ed. C. E. & A. Jour.]

REVIEWS.

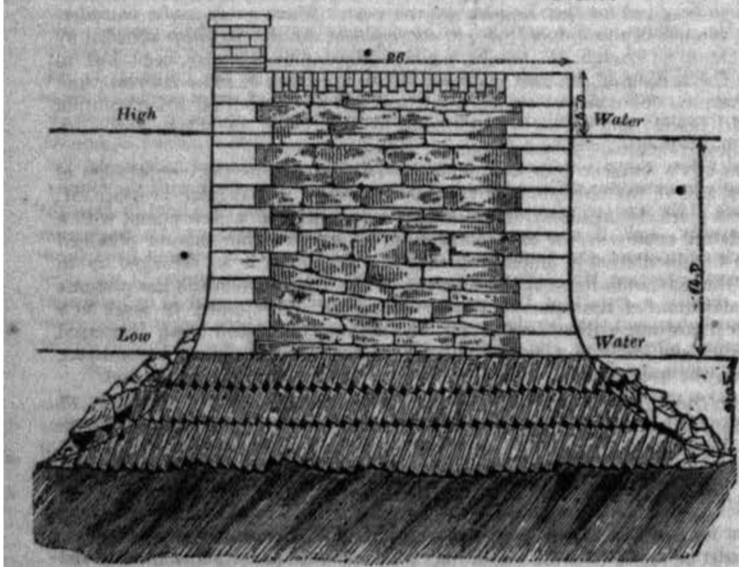
Theory, Practice and Architecture of Bridges. The theory by James Hann, *of King's College, and the practical and architectural treatises by* William Hosking, F.S.A., &c. Vol. I. London: John Weale.

Our present remarks will be confined to Mr. Hughes's paper on the "Foundations of Bridges," as we have previously noticed most of the other articles. Mr. Hughes commences his paper by taking a review of various methods of laying foundations by mean of caissons, next he explains the manner of building bridges on dry land, the stream being afterwards diverted from its old course and made to pass under the new bridge,—he then explains the method of building piers called by the French *encaissement*, practised by Belidor. Afterwards comes the method of laying, in deep water, foundations of piers, bridges, &c., without the aid of a coffer dam. As this portion of the paper will best explain the talents and capacity of its author, we shall give a lengthened extract, accompanied by the wood engravings, liberally furnished to us by the publisher.

The first work of the kind I shall describe was projected by Mr. Telford, and executed under the superintendence of Mr. David Henry, at Ardrossan Harbour, in Ayrshire, N. B.; and as the mass of stones used in the foundation was there set in tolerably regular order under water, without the aid of coffer-dam, or caisson of any kind, there can be no doubt of the same system being equally practicable in many cases of bridge foundations.

The stones at Ardrossan were of very large superficial dimensions, varying from six to ten feet long, and three to five feet wide; they were first held fast by an implement, technically called nippers or devil's claws, and were then lowered by a crane through a depth of six or eight feet of water on to a hard and solid foundation. The blocks were placed end to end, the position of the last stone lowered being found by probing with a slight iron rod; and as soon as each stone was in its place longitudinally, the claws were disengaged, and the stone allowed to rest upon the course below, as seen in fig. 1. The courses were continued entirely through the whole thickness of the pier; and when a sufficient number had been laid to bring the work up to the height of low water spring tides, the whole becadth was levelled, and all the unequal projections chipped off, in order to prepare a bed for the firs course of dressed masonry. The work then proceeded in the regular manner, consisting of alternate headers and stretchers of properly squared ashlar in front, with dry stone hearting of squared scapple dressed rubble inside, and in this way was carried up to the full height required.

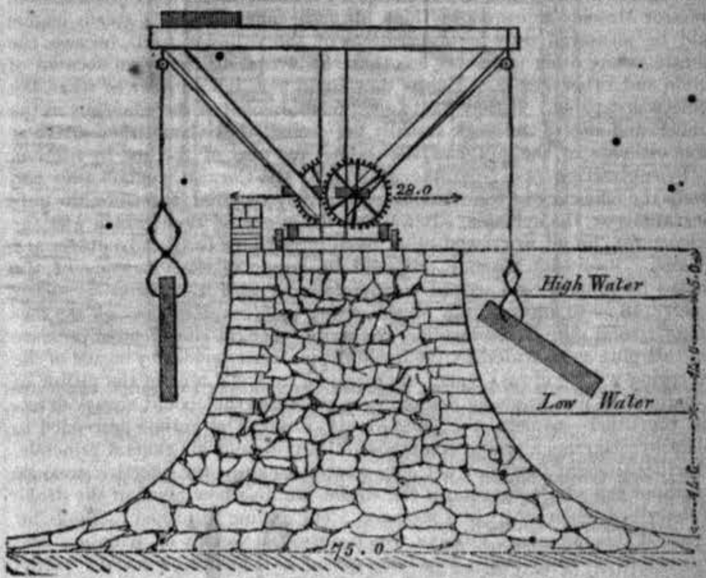
Fig. 1.



When the writer visited this work, in the year 1818, it had been advanced a considerable distance into the sea; and although parts of it had been exposed to some very heavy storms, neither flaw nor settlement could be discovered in any part of this excellent piece of dry-built masonry.

From an account of some foundations similar to that described above in the recently published life of Mr. Telford, it may be seen that the practice has been much more extensively adopted, and a far bolder attempt carried out by Mr. Gibb, of Aberdeen, than the one acted upon in the other work at Ardrossan. The pier at Aberdeen is extended into the sea, with a breadth at the base of seventy-five feet, the bottom consisting entirely of irregularly shaped masses of stone, which having been conveyed to the spot in boats, were tumbled in by chance to the depth of ten or twelve feet. In the drawings composing the Atlas, which accompanies the life of Mr Telford, the low water mark is shown about fourteen feet above the bottom, and in the narrative of this work by Mr. Gibb, he states, that the bottom under the foundation is nothing better than loose sand and gravel, and that the front ashlar commences at about one foot under low water mark, and is carried up to the top of the pier, which the drawing shows to be about thirty-three feet in height from the bottom to the top. The rise of the tide is shown to be fourteen feet, the breadth of the pier twenty-eight feet, the sides carried up with a slope inwards. Fig. 2, describes the method adopted by Mr. Gibb.

Pier at Aberdeen. Fig. 2.



The author next proceeds to describe an economical method of building the foundations of a pier as practised by Mr. Telford at Inverness, to avoid the expence of erecting a coffer dam. This is well deserving of notice on account of its simplicity, particularly the part explaining the "lewis."

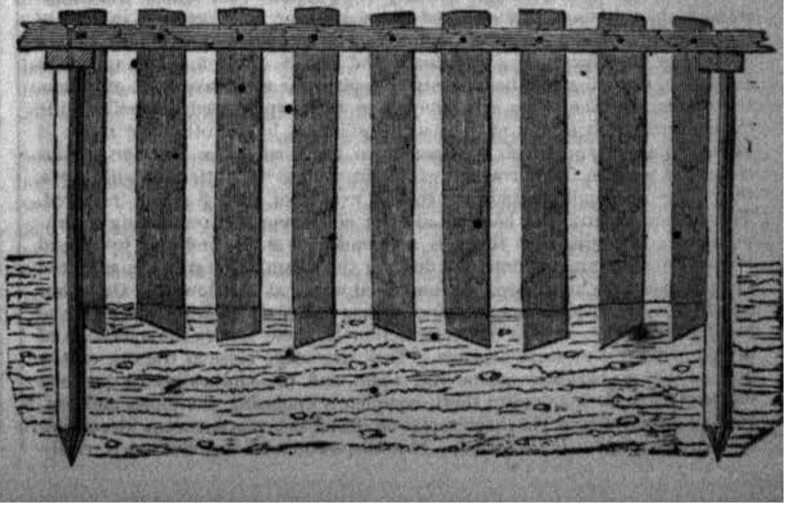
At the site fixed upon for the intended pier, the depth of water, at the lowest spring tides, was never less than four feet, and at ordinary low water five or six feet; the bottom a very hard gravel, united with clay. The whole length of the breast work was about one hundred and sixty feet, and throughout this distance the bottom was dredged out, to the width of eight feet, and depth of two feet, to receive the masonry.

A simple system of piling was however driven previous to founding the masonry. The piling consisted of two bearing piles, twelve feet long, and eight inches diameter, driven down at intervals of twenty feet; and across the heads of these piles, and level with low water mark, cross pieces of elm planking twelve feet long three inches thick, and one foot wide, were fastened with trenails. On the top of these were laid longitudinal half timbers, one foot wide, and six inches deep, secured to the cross pieces and bearing piles by rag bolts, driven into each pile head.

The accompanying sketches, figs. 3 and 4, will amply illustrate the forms and disposition of the timber work in the foundation. In addition to the bearing piles, a row of timber slabs, of inferior quality, was also driven down a few inches into the bottom, at intervals of about ten or twelve inches; these had a spike driven through them, near their heads, and into the longitudinal logs of half timbers; there were merely to answer the purpose of guide timbers, to set the stones by, and to determine the guage or breadth of the work, and were afterwards removed.

The bottom on which the pier was to be founded being now made as level

Fig. 3.



Companion to the Almanac for 1840. London: Knight & Co.

As usual this publication contains a great deal of highly interesting architectural matter, in the way both of descriptions of, and comments upon, new buildings and other improvements, illustrated with several clever wood engravings. Of these latter the subjects are, Mr. Wild's two churches at Blackheath and Southampton, the new church Park Street, Bankside, the Club-house Chambers, Regent Street, and plans, &c. of Mr. Cockerell's new buildings at Cambridge for the Public Libraries, &c. Among those buildings which, although not accompanied with any cuts, come in for a large share of notice and remarks are, Mr. Barry's Reform Club, and Mr. Tattersall's chapel at Dukinfield, as does likewise the new building in Wellington Street, for Bielefeld's Papier Maché Works.

The comments on the plan of the Cambridge Libraries are pertinent,—though, perhaps, the architect may be disposed to prefix an *im* to that epithet—and judicious; for it certainly does appear that the building will be more irregular than even the awkwardness of the site requires; nor that only externally but internally too, because many of the principal apartments will be thrown quite out of square, one of them sloping off instead of being parallel to the opposite one. It is therefore to be hoped that that part of the plan will be reconsidered before it shall be actually began.

We shall quote only two of the minor paragraphs:

Keswick Church, lately erected by Mr. Salvin, is a stone edifice in the early pointed style, of about the time of Henry II, with a tower, surmounted by a low spire, and a small octagonal building, attached to the south side of the church, for a vestry room. This latter is covered by a very steep, or spire-shaped roof, and forms a very striking feature in the design, to which it imparts a great degree of picturesque variety. This church was commenced by the late John Marshall, Jun., Esq., and has been completed by his widow. It is not capable of containing more than 412 persons, viz., 48 in pews and 364 in free seats. Cost, £6,280.

Darlington Church, another work by the same architect, is very different in design, being a long and low but high-roofed structure, of rather primitive character, with small and plain pointed windows, at irregular intervals, and a square tower (in which is a porch) on the north side. It was built by subscriptions and donations for the sum of £3,254; yet, although the cost is little more than half that of the preceding building, it is capable of accommodating more than double the number of persons, viz., 1,010; 410 in pews and 600 in free sittings."

In a previous part of the volume is a section upon "Railways," containing much statistical information on that subject.

Manchester as it is, with numerous Steel Engravings and a Map. Manchester: Love and Barton.

This is a very useful and interesting little work, descriptive of all the public buildings, institutions, exhibitions, canals, warehouses and manufactories, in short it appears to contain all the information that a visitor may wish for as a guide to Manchester. We select the following extracts to show the nature of the work.

STEAM ENGINE MAKING, AND ENGINEERING.

One of the principal establishments in Manchester, in these departments, is that belonging to William Fairbairn, Esq., situate in Canal-street, Great Ancoats-street. To persons unacquainted with the nature of working in iron, an admission into these works affords, perhaps the most gratifying spectacle which the town can present of its manufactures in this metal. Consequently, almost every person of distinction visiting the town contrives to procure an introduction to the proprietor before leaving it. In this establishment the *heaviest* description of machinery is manufactured, including steam engines, water wheels, locomotive engines, and mill geering. There are from 550 to 600 hands employed in the various departments; and a walk through the extensive premises, in which this great number of men are busily at work, affords a specimen of industry, and an example of practical science, which can scarcely be surpassed. In every direction of the works the utmost *system* prevails, and each mechanic appears to have his peculiar description of work assigned, with the utmost economical subdivision of labour. All is activity, yet without confusion. Smiths, strikers, moulders, millwrights, mechanics, boiler makers, pattern makers, appear to attend to their respective employments with as much regularity as the working of the machinery they assist to construct.

In one department mechanics are employed in building those mighty machines which have augmented so immensely the manufacturing interests of Great Britain, namely, steam engines. All sizes and dimensions are frequently under hand, from the diminutive size of 8 horses power, to the enormous magnitude of 400 horses' power. One of this latter size contains the vast amount of 200 tons or upwards of metal, and is worth, in round numbers, from £5,000 to £6,000.

The process of casting metal is conducted here on a very large scale. Castings of twelve tons weight are by no means uncommon: the beam of a 300 horses' power steam engine weighs that amount. Fly-wheels for engines, and water-wheels, though not cast entire, are immense specimens of heavy castings. A fly-wheel, for an engine of 100 horses' power, measures in diameter twenty-six feet, and weighs about thirty-five tons. In this establishment some of the largest water-wheels ever manufactured, and the heaviest mill-geering have been constructed; one water-wheel, for instance, measuring sixty-two feet in diameter. The average weekly consumption of metal in these works in the process of manufacturing, owing to the quantity of wrought iron used, and the immense bulk of the castings, is 60 tons or upwards, or 3,120 tons annually.

The preparation of patterns,—wood fac-similes of the castings,—is a very costly process. Every piece of machinery, before it can be cast, must be constructed in wood; and these *patterns*, as they are termed, are made to form, in sand, the mould into which the liquid ore is poured. Fifty men are daily employed in making patterns, The patterns, which are part of the proprietor's *stock in trade*, are worth many thousand pounds. After being used, the most important are painted and varnished, and laid carefully aside, in a dry room, to be ready for use when machines may accidentally get broken, or to aid in the construction of new ones. The patterns are made frequently of mahogany.

A most curious machine is employed for the purpose of *planing iron;* and, by means of its aid, iron shavings are stripped off a solid mass of metal, with, apparently, as much ease as if it were wood, and with the greatest regularity and exactness. Not the least interesting department of these works is that appropriated to boiler making. Boilers, for steam engines, are composed of a number of plates of wrought-iron, about $\frac{3}{8}$ of an inch in thickness. They are riveted together, with rivets about $\frac{3}{4}$ of an inch diameter, holes to receive which are punched through the plates, by a powerful, yet simple, machine, with as much facility as if the resistance was mere air. The process of riveting was, on the *old method*, an extremely noisy one; but a new plan, is adopted here, and by it the work is performed silently, and much more efficiently. Some time ago about 50 boiler makers were employed by Mr. Fairbairn. The "struck," as it is termed, because their employer infringed, as they considered, upon their privileges, by introducing a few labourers, not in "The Union," to perform the drudgery connected with the work. On this occurring, Mr. Fairbairn and Mr. Robert Smith invented a machine which superseded the labour of 45 out of the 50 of his boiler makers. The work is performed by the machine much quicker, more systematically, and, as before said, without noise.

LOCOMOTIVE ENGINE AND TOOL-MAKERS.

Under this head may be classed several extensive works, in and about Manchester.* One of the largest is that possessed by Messrs. Nasmyths, Gaskell & Co., situated at Patricroft, four and a half miles distant from Manchester, and immediately adjoining the Liverpool and Manchester Railroad, at that part where it crosses the Bridgewater Canal, which great national work forms the boundary or frontage of the ground on which the above establishment is erected, and which, in consequence, has been named, "The Bridgewater Foundry."

These works have a frontage to the railroad, as well as to the canal, to the extent of 1,050 feet; which circumstance supplies every possible facility for communication, either by land or by water carriage. One of the "stopping stations" of all the second class trains being opposite, persons desirous of visiting these works, can be set down at the entrance gate. The distance in *time*, from Manchester, is only from ten to fifteen minutes.

The above establishment is of very recent erection, having been in existence only about two and a half years. There are employed at present about 300 men: the greater part of whom, together with their families, live in cottages which the proprietors have erected for their accommodation. The situation of these works is not only most admirably adapted for the purposes for which they have been erected, but it also secures, in a great degree, good health to the men employed; for, being surrounded on all sides with green fields, and being, moreover, on the *west* side of Manchester, a very long lease of pure air is secured; a circumstance of no small importance, as regards the health and comfort of the workmen employed.

The whole of this establishment is divided into departments, over each of which a foreman, or a responsible person, is placed, whose duty is not only to see that the men under his superintendence produce good work, but also to endeavour to keep pace with the productive powers of all the other departments. The departments may be thus specified:—The drawing office, where the designs are made out; and the working drawings produced, from which the men are to receive the necessary information. Then come the pattern-makers, whose duty is to make the patterns, or models in wood, which are to be cast in iron or brass: next comes the foundry, and the iron and brass moulders; then the forgers or smiths. The chief part of the produce of these two last named pass on to the turners and planers, who, by means of most powerful and complete machinery, execute all such work on the various articles as require either of these operations; besides which, any holes that are required are at this stage bored, by a great variety of drilling machines, most of which are self-acting. Then come the fitters and filers, who, by means of chisels and files, execute all such work as requires manual labour, and perform such delicate adjustments as require the individual attention of the operative: in conjunction with this department is a class of men called erectors, that is, men who put together the frame-work, and larger parts of most machines, so that the two last departments, as it were, bring together and give the last touches to the objects produced by all the others. A machine having passed through these departments, is now ready for a coat of paint, which having received, it is taken to pieces (after all the parts are marked, so as to enable its being put together when it arrives at its destination), the bright parts are smeared with tallow, and, if required, placed in packing cases, which are then handed over to the foreman of the labourers, who, by means of the crane or railroad, place them in the canal boat or railway waggon.

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* Messrs. Sharp, Roberts, & Co.'s, Messrs. Peel, Williams, & Co.'s, are among the first in importance,

With a view to secure the greatest amount of convenience for the removal of heavy machinery from one department to another, the entire establishment had been laid out with this object in view; and in order to attain it, what may be called the straight line system has been adopted, that is, the various workshops are all in a line, and so placed, that the greater part of the work, as it passes from one end of the foundry to the other, receives, in succession, each operation which ought to follow the preceding one, so that little carrying backward and forward, or lifting up and down, is required. In the case of heavy parts of machinery, this arrangement is found exceedingly useful. By means of a railroad, laid through, as well as all round the shops,* any casting, however ponderous or massy, may be removed with the greatest care, rapidity, and security. Thus nearly all risk of those frightful accidents, which sometimes occur to the men, is removed. The railroad system is now beginning to be as much attended to, and its advantages felt in concerns of this nature, as it is in the transit of goods and passengers.

Nearly one uniform width is preserved throughout all the workshops of this extensive concern, namely, 70 feet; and the height of each is twenty-one feet to the beam. The total length of shops on the ground floor, already built, amounts, in one line, to nearly 400 feet. There are, besides, four flats of the front building, each twelve feet high, 100 feet long, and 60 feet wide. Into these rooms a perfect flood of light is admitted by very large windows on the side walls, as well as through sky-lights in the roof.

The Foundry occupies one portion of this building, namely, 130 feet by 70 feet, in which great apartment or hall there is not a single dark corner: a point of vast importance where the operations are conducted with a black material, namely, the moulding sand. The iron is melted in one or more of four cupolas, according to the weight of the casting. The cupolas vary from three to six feet in diameter, and when all are in active operation, melt thirty-six tons of iron. The great cauldron, or pot, in which the metal is contained, is placed, during its transit from the furnace, on a carriage, which moves along a railroad in front of the four cupolas; and thus any portion of melted metal can be received and conveyed, with the most surprising rapidity and ease, to any point of the surface of this great hall. These great pots contain, at times, each six or seven tons of melted iron, and, by means of a crane, whose arms sweep every part of the foundry, are handed from place to place as if wholly devoid of weight. The crane posts are two great cast-iron columns, around which the crane arm swings. The columns serve at the same time as supports to the roof, and by proper ties, the strain of such great weights is diffused over the whole building, and each brick made to share the load. The *blast* of air for the furnaces is supplied by a fanner, five feet in diameter, made to revolve at the rate of 1,000 revolutions per minute, the air or blast being conveyed under ground in a brick tunnel, from which it is distributed to each furnace by sheet-iron pipes, varying from three to nine inches, according to the size of the furnace at work at the time.

There are at present fifty-six turning lathes, of all sizes, at work in this establishment. several of which are what is called self-acting,†—that is, the work has only to be placed in the lathe, and the tool set, and the machine does the remainder of the work with unerring accuracy and ease.

Planing machines are extensively used here. The immense power of one of these machines may be imagined, when it is considered that the amount of resistance against the edge of the knife which planes the iron is, in a large machine, as much as thirty tons. This fact leads to the consideration of the hardness of the instrument which has to encounter, for perhaps a day together without becoming inoperative, this immense resistance. By means of this admirable machine every variety of geometrical figure can be produced with the most absolute accuracy—such as the plane, the cylinder, the cone, and the sphere. And as all possible varieties of machinery consist merely of these figures in combination, there is now every facility for producing whatever may be required.

Besides the manufacture of every description of engineers' tools, another branch of business for which this establishment has been erected, is that of locomotive engines, a branch of business which is rapidly acquiring great importance, and which will have few rivals as to magnitude. Lancashire appears to be completely taking the lead in this manufacture, which, from its very nature, can be carried on only on a large scale.

The room occupied by the steam, in a locomotive boiler, is ordinarily equivalent to ten cubic feet. Ten cubic feet of water will produce in steam, when expanded to the density of the atmosphere, as much as would occupy 18,000 feet of space. The steam is confined in the boiler by a pressure three times that of the atmosphere, so that, escaping from its confinement, it expands to three times the space it there occupied.

Architectura Domestica, von Alexis des Chateauneuf. Large 4
London: Ackermann and Co.

Recent circumstances have given this volume additional interest and recommendation, its author having obtained the second premium in the competition for the Royal Exchange, owing to which his name is no longer a stranger to English ears; and it may, perhaps, be worth while to remark that it had actually appeared prior to that event, consequently it was not the distinction he had so obtained which induced M. de Chateauneuf to bring it out in this country. Whatever may have been his motive for publishing it here, we hope he will have no reason to repent having done so, although we dare not flatter him by saying that he could not have selected a better market; because, if the truth may be spoken, there is far less encouragement given to works of this class here in England than on the Continent. However, we hope that M. de C. will find that there are exceptions to the rule, and that his own case is one of them. Still, one inconvenience we suspect has been occasioned by the work having been got up here, namely, that the author has in consequence been obliged to trust too much to others; and although as far as correctness and intelligence of form go, he could not, perhaps, have employed a more able engraver than Mr. T. T. Bury, we must say that delicacy of outline has been carried by him somewhat to excess. The breadth and depth, or rather the fineness of the lines, is so uniform as to produce a general faintness of effect; whereas, variety of line would have given not only greater vigour, but distinctness, also to many of the plates. Mr. Bury would have done well to have looked at some of the architectural subjects in Penier's work on decoration; which, independently of their intrinsic interest, captivate the eye at the first glance, by the union of firmness and delicacy, which gives adequate relief to every object. This tameness in the execution of the plates certainly does not affect the designs themselves, otherwise than it exhibits them somewhat to disadvantage, and sometimes is attended with a degree of insipidity that may unluckily chance to be attributed to the subject, instead of the engraver's treatment of it. These remarks, we think, are called for, even in justice to M. de Chateauneuf, for there are one or two designs, which, had they been better expressed, would have been considered of more importance than they are now likely to be.

To come now to matter of the plates, we scruple not to say that although the designs display great inequality, on account of the very great difference of their subjects, some of the designs being for very small and unpretending buildings, while others afforded more than usual scope for invention—they give evidence of real talent and originality. Yet, being nearly all those of buildings executed for private individuals, the author has, in all probability, been more or less checked or thwarted, if not directly by his employers, by circumstances he was obliged to keep in view, and which prevented him from giving free scope to his own taste and imagination. What is most important is, that many excellent ideas and suggestions may be obtained from them. One of the happiest is that shown in plate 5—namely, a perspective interior of a Holstein barn converted into a garden or rustic saloon, and retaining just enough of the original character to show what has been the architect's motive. It might, perhaps, be pursued still farther, and thereby be found to lead to very much more; especially as regards the form of the ceiling, which might either throughout or in the centre compartment of such a room, be carried up higher than the walls, in two inclined planes, following the slope of the large truss brackets supporting the horizontal beams of the ceiling. The style is both well imagined and well kept up, and the whole is exceedingly pleasing, consistent, and harmonious, though obnoxious to objection from those who would indiscriminately proscribe every thing that is not supported by actual precedent, although indulgent enough towards all which is so authorized, no matter how bad it may be in itself. Granting the merit to be equal, or nearly so, in other respects, we should say that a design which brings forward some novelty is the better suited for publication; particularly in works of which the object either is or ought to be to bring forward fresh ideas, and such *motives* of plan or decoration as may be turned to account, by being adopted as a hint, without being either copied or even so treated as to lead at once to the source of it. This has not always been so well attended to as it ought to have been, else we should not meet with so many published designs as we now do, which afford no other instruction than what might just as well be obtained from almost anything else of the same kind. Such, we apprehend, will be found to be the case with the subject following the one we have just been speaking of; which consists of the plan and perspective view of a villa erected near Lubeck, for Dr. Buckholtz; but which we are by no means disposed to receive as earnest of what the author would be capable of producing, if at liberty to abandon himself freely to the impulses of his own taste. Most certainly will not bear comparison with that of an English house of the same size; the arrangement is undoubtedly simple enough, but too simple for either convenience or effect, and would, therefore, have, perhaps, been all the better, had some positive difficulty occurred, which it would have been necessary to combat.

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* Abbreviation of "work-shops."

† "We may here with propriety say a word on the subject of self-acting tools, the more so because it is by means of these admirable adaptions of human skill and intelligence that we are giving to the present age its peculiar and wonderful characteristic, namely, the triumph of mind over matter.

"By whom or when the *slide*-principle was first introduced we need not now enquire; suffice it to say that, by means of this principle, a most wonderful substitute has been found for the human hand in the fabrication of almost all parts of mechanism, whether the substance to be operated upon weighs tons or grains. The slide principle is that which enables a child, *or the machine itself*, to operate on masses of metal, and to cut shavings off iron, as if it was deprived of all hardness, and so mathematically correct that even Euclid himself might be the workman! It is by the slide principle that we are enabled to fix a steel cutter into an iron hand, and constrain or cause it to move or slide along the surface of a piece of metal in any required direction, and with the utmost precision. By means of this principle all the practical difficulties hitherto encountered in the extending and improving of machinery generally, were, at one blow, cleared away. By its means the formation of every geometrical figure became a matter of the greatest ease, and a principle of absolute and unerring exactness took the place of manual dexterity.

"The impulse given by the slide principle, to the manufactures of this country, in the construction of machines for forming other machines, can scarcely be imagined. On the application of an unerring principle to *machine-making machinery*—which *tools* may be defined to be—the mechanical energy of Great Britain, sprang forward at once to that supreme station which she now maintains, and which, if her artisans keep pace with the times, she will ever retain."—*Note by a Practical Engineer.*

There is no doubt that such difficulty has mainly led to much of the beauty and variety of plan observable in Dr. Abendroth's house at Hamburg, built by the author between the years 1832-6, and which here forms the principal subject of his volume, being illustrated not only by four plans, and elevation, and a section, but by two perspective views, (one of the staircase, the other of a semicircular apartment), but also by several plates of details. The façade of this mansion or *palazzo* is in what may be called a Grecianized Italian style, much of the detail being evidently of the former character, though the composition and its general features stamp it as decidedly belonging to the latter. Although it is *astylar*, or columnless, it is greatly more decorated than almost any specimens of the class we have in London—much more so, in fact, than two which are likely to be quoted as among the very few that can be named at all, viz., Sutherland House, and that of the Duke of Wellington; since both of them are in an exceedingly cold and bald style of architecture, and with a remarkable poverty of feeling about them; and extreme meagerness and flatness of detail. It is, however, in the interior of this mansion that the architect has cheifly manifested his talent, by much happy invention, contrivance, and taste; and a careful study of the plans will show that there is a great deal of effect which is not very apparent upon a cursory inspection of them. So far from complaining that this single subject occupies too many of the plates, we could have wished one or two more had been devoted to it, either as additional sections, or exterior views, one of which ought, of course, to describe the small oblong hexagonal cabinet, with a semicircular alcove occupying the side facing the centre window; which unusual form—so pleasing in itself, and throwing so much variety into the suites of rooms, has been occasioned entirely by the awkwardness of the site, and the disagreeably sharp angle, the two fronts would else make at that corner of the building. The stair-case is exceedingly tasteful, and exhibits what we take to be altogether a novelty—having never before met with, nor heard of, any similar instance, namely, an internal pediment over the colonnade, produced by the ceiling being composed of two inclined planes, each half of which, where they unite at their ridge, is glazed to serve the purpose of a sky-light.

"The great saloon is adorned with casts of Thorwaldsen's frieze of the triumphal entry of Alexander into Babylon, the more valuable because the greater part of the casts were taken from the clay models of the master.

"The colossal busts of the divinities in the niches of the stair-case, are the work of Seigel. The images of the planets and fixed stars of the painted glass ceiling are from the designs of Edwin Specker. The corner cabinet of the principal story is decorated with arabesques, after designs by the same master, painted in encaustic, by Milde. Unhappily, it was too difficult to represent such sportive fancies in their forms and colours in these outline plates."

After making some of the remarks we have done, it would be preposterous in us now to say that the volume consists entirely of the author's best specimens; though it contains much that is of great interest, we are persuaded that M. de Cheteauneuf could render it more valuable; and we hope that either another edition, or anothe collection, will afford him the opportunity of profiting by our criticism; and if our praise has been somewhat qualified, where we have bestowed it has been sincere—and had there been less striking merit in some of the designs, we might, possibly, have thought better of others among them, than we now do.

Euclid's Elements of Plane Geometry, with Explanatory Appendix, and Supplementary Propositions. By W. D. Cooley, A. B. London: Whittaker and Co., 1840.

Mr. Cooley, in producing this work, seems almost to wish to contradict his own motto, that "there is no royal road to geometry," for following in the steps of Playfair, he has considerably diminished both the volume of the work, as well as the labour of the student. He has carefully gone over the elements, and greatly reduced the amplications and reiterations, which made former editions prolix, and he has, wherever it was possible, substituted the ordinary arithmetical and algebraical signs. As he himself says, without in the slightest degree injuring the work he has reduced to 120 duodecimo pages the Six Books of the Elements.

Prefixed to the Elements are some remarks on the study of mathematics, as valuable for the elegance of their style, as for the correctness of their reasoning. The importance of departing from the ordinary school rate of teaching cannot be too strongly enforced.

At the end of the work are some notes and exercises on the several books, in which Mr. Cooley gives his reasons for inserting a few fanciful definitions of Playfair. To Playfair we are much indebted, but it must not be forgotten that he was often led away by his turn of mind into mere verbiage, making distinctions without a difference.

Outline of the Method of a Conducting Trigonmetrical Survey, by Lieutenant Frome, Royal Engineer, F.R.A.S., and A.I.C.E. London: Weale, 1840.

This is the production of one of the Professors in the Military College at Chatham, and supplies a great desideratum in professional literature. Lieutenant Frome is both practically and theoretrically qualified for this task, and has, therefore, produced a work valuable for its own original merits, and for its careful collation of the best authorities. It shows very strongly the mischief of a government system that a man of such experience and capabilities should be only a Lieutenant, waiting like his less talented and less employed brethren for the Procrustean reward of a rise by seniority.

The work is well arranged, and of a high character going into the practical details of the subject much more deeply than its modest title would induce the reader to believe. From a work of this nature it is difficult to make any selection, but we intend at some future period to extract two or three supplementary portions. We must leave it, therefore, to our readers to take our word for the valuable character of Lieutenant Frome's work.

Ornamental Gates, Lodges, Pallisading and Rails of the Royal Parks, &c. Part 1, containing 25 Plates, Edited and Published by John Weale.

The designs are principally the Park Lodges and Entrance Gates of Regent's Park and Hyde Park—the elaborately enriched gates to the royal entrance of the New Palace, and the gates and railing to the entrance of the Sultan's Palace, at Constantinople. There are also plans of St. James's Park, Kensington Gardens, and Regent's Park. The whole are very delicately and beautifully engraved in outline.

The Guide to Railway Masonry, by Peter Nicholson.

This work is a complete treatise on the Oblique Arch, and contains numerous engravings, illustrating the subject. The author has devoted considerable pains in giving every detail by which a working mason may be able to set out any part of the stone work of a bridge with facility.

The Comic Latin Gramar has been sent to us, a work most admirably illustrated. Whether the design be jest or earnest we do not know, but it is likly to be an equal favourite with the elder as well as the juvenile part of the community.

Voltaic Engraving.—Considerable interest has been lately excited in the scientific world by Mr. Spencer's new process of copying medals and other works of art in copper, by the agency of voltaic electricity. It is with great pleasure that we hear that this process is already beginning to be employed in certain of our manufactures, and that thus electricity will soon be numbered amongst the agents employed for practical and useful purposes. In our former account of Mr. Spencer's invention we spoke highly of the merit of the discovery, and the probable uses to which it might be applied: the result has borne out our anticipations. In the manufacture of plated articles and ornaments, it is often desirable to copy ornamental work, such as leaves, flowers, and arabesque mouldings; this is both difficult and expensive, and from these causes often impossible. Mr. Spencer's invention, however, affords a cheap and easy method of performing what is required, and thus, ornaments on rich ancient plate are copied with the greatest perfection and ease, and without injury to the original. The great advantage consisting of the means of obtaining, at very small expense, a fac-simile in copper, of the ornaments required to be copied, which may then be silvered or gilt. In another art, the voltaic process is, we are informed, being successfully introduced. The makers of buttons often require to have two or three of a particular pattern to complete a set of which they have not the die. To take a cast from the button is, for many reasons, inconvenient and objectionable; and the voltaic process, at the cost of a few hours and very little labour or expense, furnishes a perfect fac-simile of the button, which then only requires to be gilt. It has been said that there is a difficulty in obtaining perfect copies, and that the deposited copper is brittle, porous, and full of holes; but whoever will read attentively the process of Mr. Spencer and follow it, must succeed. The cast of medals transmitted to us by Mr. Spencer, and also those made by Mr. E. Solly and Mr. J. Newman, and exhibited lately at the meeting of the Society of Arts, were very pure and compact copper, and the surface was as brilliant and perfect as could be desired. The process, indeed, is simple, and so far from its requiring, as is generally supposed, either expensive and complicated apparatus, or deep scientific knowledge, nothing can be more easy, as the observance of a few rules renders the success of the process quite certain, and, as regards the expense of the apparatus, the whole of it may be easily procured for a few pence.—*Athenæum.*

LAW PROCEEDINGS.

THE CYCLOIDAL PADDLE-WHEEL.

Mr. Galloway's patent right, which has been disputed ever since the patent was granted, was brought on for trial in the Court of Common Pleas, on Friday and Saturday, November 29 *and* 30, *before* Lord Chief Justice Tindal, *and a Special Jury; it occupied the Court two days.*

GALLOWAY AND ANOTHER V. BLEADEN.

The case on the part of the plaintiffs was that Mr. Galloway had invented an improved paddle-wheel for propelling steam-vessels, for which he obtained a patent on the 18th of August, 1835. The invention consisted in a division of the floats into segments, and so arranged in a cycloidal curve as to cause all the five or six segments into which each float was divided to enter the water at the same time, and at such an angle as most diminished the shock occasioned to the vessel by each stroke of the paddle; whilst the segments, when the float reached a vertical position in the water, became joined together as it were, so as to present an undivided surface to the water, and so increase the power of propulsion; and lastly, the float, when passing out of a vertical position, by becoming again divided, offered less resistance to the back water, and, consequently, less retarded the speed of the vessel than if undivided. The action was brought against the defendant, as secretary to the Commercial Steam-packet Company, for an infringement of this patent; to which he pleaded, in addition to the general issue of not guilty, that the invention was not new, as it had already been discovered and used by Mr. Field in 1833; and that the specification was not sufficiently intelligible to render the invention of general utility to the public. Several models illustrative of the alleged invention, were produced, and a comparison made between them and models of the wheels of two of the defendant's vessels, the Grand Turk and the Chieftain, to show that the latter were made upon the principle of the plaintiff's specification. Witnesses were also produced to prove that workmen of competent skill could make the patent wheels from the information contained in the specification, and that the improvement in question was not known in the trade previously to the date of the plaintiff's patent.

The defendant's counsel relied mainly on the ground that the invention had been discovered and used long before the date of Mr. Galloway's patent by Mr. Field, of the firm of Maudslay and Field; and that gentleman, being called as a witness, stated that in 1833 he constructed a wheel on the improved principle now in question, which, upon application to the Lords of the Admiralty, he obtained a promise from them that he should have an opportunity of trying upon the first vessel that came to be prepared; that opportunity, however, was never afforded him, but he made an experiment upon a steam-boat, called "The Endeavour," plying between London and Richmond, by substituting one of his improved wheels (of which a model was produced in court) for one of the Endeavour's wheels. At the end of six weeks, however, the new wheel was removed and the old wheel replaced; because, according to the statement of the captain, the boiler was not large enough for the machinery to work it properly. In that same year he entered a *caveat* at the Patent-office; and in 1835 he made a great number of experiments on the subject at his manufactory; but it was not until the spring of 1836 that he fitted up a vessel called the Dover castle with wheels upon the improved principle, which were similar to the wheel tried upon the Endeavour in 1833.

The defendants, it was urged, had twice acknowledged the plaintiff's patent right, having on one occasion purchased their patent wheels for one of their vessels, and on another, in 1837, paid them 50*l.* for a licence to use their specification in constructing wheels for them.

The Lord Chief Justice summed up the case to the jury, and left three questions for their decision; namely, whether there had been any infringement of the plaintiff's patent by the defendants: whether the invention was new and unused at the date of the plaintiff's patent; and whether the specification was sufficient. With respect to the principal question, as to whether or not the invention was new, the mere fact of a series of experiments having been prosecuted previously to the attainment of the object to which they were directed, could not prevent another inventor from availing himself of the experiments, and then adding the final link which was necessary to bring them to a successful issue. If, therefore, the jury thought that up to the month of August, 1835, the date of the plaintiff's patent, all that Mr. Field had done rested in experiments, those experiments afforded no ground for disturbing the plaintiff's patent, and in that case their verdict should be for the plaintiffs.

One of the jury wished to ascertain whether the wheel tried on the Endeavour was on the principle of the cycloidal curve; or, if the model of it were not in evidence, whether it might not be examined and compared with the original by some competent person.

This question gave rise to some discussion between counsel; ultimately,

The learned Judge said that, as the person who had made the model was not present, he could not allow it to go before the jury.

The jury then returned a verdict in favour of the plaintiffs, with nominal damages.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ARCHITECTURAL SOCIETY.

INSTITUTED A.D. 1831—SESSION 1839-1840.

5th Nov., 1839.—William Tite, *Esq., President, in the Chair.*

This evening's meeting, the commencement of the session, was devoted to a conversazione. It was very fully attended. The Secretary read the report of the committee. The President read a highly interesting paper "on the sculptured writings found on the architecture of the Egyptians, with a notice of the discoveries which led to their being deciphered."

The attention of the meeting was directed to the several works of art which were about the room—noticing more particularly various models in terra-cotta, from Messrs. Sollin, Morton, and Co.'s establishment, of the Strand; also a model of an Egyptian obelisk in black marble, together with other models of buildings, &c. Some original sketches by Mr. George Moore; portfolios of prints, by Hawkins and others.

Report of the Committee.

Gentlemen—This evening being the opening conversazione of the session, it may naturally be expected by the visitors and members who have kindly favoured us with their attendance, that the Committee should state the views they, on behalf of the Society, intend to adopt during the present session, and at the ensuing evening meetings; and they trust that the suggestions which have been offered, and which they propose to adopt for the further carrying out of the objects of the Society may produce an increased interest in their evening meetings, and may meet with the concurrence and personal exertions of the members generally for their fulfilment.

The Committee first remark that they have been successful in securing the assistance of Messrs. Addams and E. W. Braley, jun., (as Professors) to deliver lectures at the monthly meetings, and that on the intermediate evenings of meetings they have procured the promise, on the part of several of their own members, to deliver lectures, or otherwise to read papers having reference to matters of architectural practice and interest, the subjects of which, in all cases, it is proposed should be announced at the previous evening meeting.

Secondly—the Committee considering that this mode of instruction (by lectures) is provided, more particularly for their class of Student Members, propose, as a means whereby these advantages may be made the more available to the interest of that class, that the Student Members should take notes of the several Professors' lectures, and as a stimulus to a due attention to this portion of the benefits offered to them by this institution, have determined that the subject for the prize usually given for the best essay should be "The best fairly transcribed notes of the Professors' lectures."

And while on the subject of prizes, the Committee have the pleasure to announce that they have received the list of the subjects from the Sketching Committee, for which the premiums will be awarded to the class of Student Members, at the close of the present session.

The prizes to be awarded are—in the first class, design, a pair of silver compasses; second class, drawing, Chambers's Civil Architecture (Gwilt's edition); third class 5th volume of Britton's Antiquities. Beside these prizes, which are given by the Society, the Committee have the pleasure to announce that Mr. George Mair has signified his intention to award the usual prize, entitled George Mair's prize, to be given to that student who produces the greatest number of the most approved sketches from given subjects; the sketches to be made in accordance with the directions of the Sketching Committee.

FIRST PRIZE.

The subject for the design is a concert room, with the entrance, vestibule, and cloak rooms—the length of the concert room to be 80 feet, with a gallery at one end. The orchestra to consist of an isolated raised platform on the ground floor.

The style to be either the Greek or Roman architecture.

The drawings to consist of plan, longitudinal, and transverse sections, front and side elevations, to a scale of 1-6th of an inch to a foot; to be accompanied by a prespective view, and the drawings to be finished in Indian ink, or Sepia

SECOND PRIZE.

The subject for the measured drawings is the colonade to Burlington House.

The drawings to consist of the plan and elevation to the scale of 1-6th of an inch to a foot, with the plan and elevation of one compartment to the scale of ½ an inch to a foot, and details of the order ⅛ the real size.

The whole of the prizes will be inscribed.

The Committee, not unmindful of the advantages and encouragement the Society receive from the Amateur Members, beg to state they have determined to extend the privileges of that class of members, and that those gentlemen may henceforth, in addition to their former privileges, also have reference to, and the use of, the Society's library and documents at all times of the day, without any restriction; and the Committee trust that this arrangement, which places their privileges on a level with those of the members themselves, so far as the use of the Society's rooms is concerned, may meet the views and wishes of that portion of their members.

In conclusion, the Committee have the pleasure to remark that during the recess several additions have been made, both to the library and museum, and it is hoped that, under the able counsel of their excellent President, the united co-operation of the members themselves, and the flattering support elicited from the attendance of the visitors, that the Architectural Society may have the gratification of finding that the meetings of this session may be as advantageously and as satisfactorily concluded as those of its former sessions.

19th Nov.—WILLIAM TITE, *Esq., President in the Chair.*

Mr. BLYTH read a paper on commemorative monuments.

The President announced that Mr. John Blyth (Vice-President) had communicated his intention to give a prize of the value of five guineas, for the best drawing of a plaster cast of the human figure, from some specimen in the possession of the Society. The prize to be awarded at the close of the session, and to be described accordingly.

At the solicitation of the student members, the President announced the subjects which had been selected for the prizes, and the resolutions passed last session, assigning the qualifications for the competitors for the prizes were referred to, and read as follows:—"That no student shall be allowed to compete for either of the prizes awarded by the society, who shall have completed his articles, and that the society only award the prizes to students under articles."

Also, "That the same regulation do apply to any private prize, which may be offered for the further encouragement of the class of student members."

3rd December, 1839.—WILLIAM TITE, *Esq., President, in the Chair.*

The President gave notice that the subject selected for Mr. Blyth's prize was the figure of "the Atlas." The figure to be drawn 18 inches high, and to be shaded in lines with pencil or ink.

The meeting was then favoured by a very interesting and instructive lecture by Mr. Hemming, the subject of which was "Iron."

17th December, 1839.—WILLIAM TITE, *Esq., President, in the chair.*

The President gave notice that the Hon. C. Cavendish had given his assent for the students to measure the colonnade of Burlington House; and that, by the obtaining of which the committee were enabled to complete the list of subjects for the prizes to be delivered at the close of the session.

The President read the list of subjects as prepared by the committee, together with the rules and regulations to be observed by the students competing for the same. The list of subjects, &c., was ordered to be be hung up in the society's room.

The President announced a donation from the Archutectural Society of Berlin of the third volume of the Architects' Album, published by that body.

Mr. Addams delivered a lecture "On the strength of beams to resist pressure and impact." He referred to iron as well as wood; and in the course of the lecture gave some excellent tables, whereby an easy calculation might be made as to the weight any iron beam would carry.

Mr. Pocock explained to the meeting a new material he had manufactured for the purpose of roofing in lieu of slating, &c., a specimen of which was lying upon the table.

STEAM NAVIGATION.

THE 'CYCLOPS' STEAM ENGINE.

ON Friday the 13th of December, this splendid vessel left her moorings at Blackwall, for a trial trip down the river, and to proceed to Sheerness to take in her guns and equipments. This being the largest steam frigate in the world excited much attention, and throughout her passage down the river, was an object of great curiosity and admiration.

The trial was made under the directions of the Lords of the Admiralty and their officers, several of whom were on board, viz., Sir C. Adam, the Secretary of the Admiralty Mr. Moore O'Ferrall, Sir E. Parry, Sir William Symonds, Captain Nott, Captain Austin, &c. &c.

Her performance was most excellent, the speed was found to be about 10 knots, or 11½ miles, her engines working 21 strokes; and it was universally remarked that there was an entire absence of the unpleasant tremulous motion so generally found in other steamers.

After proceeding close to the Nore Light, she turned and met the "Fearless" Admiralty steamer, which accompanied her down, and their Lordships embarked in that vessel to return to Woolwich, while the "Cyclops" proceeded up the Medway, and made fast to the buoy off Sheerness Dock-yard.

This vessel was planned by Sir William Symonds, and built under his immediate superintendance at Pembroke dock-yard; she combines in a most eminent degree the qualities of both sailing and steaming, together with such improvements as have suggested themselves to her designer from the experience of the "Gorgon."

She is propelled by two engines of 160 horse power each, made by Messrs. J. & S. Seaward and Capel, on the new principle adopted by them, by which they dispense with the large cast-iron side frames and sway beams, the cross heads, side rods, &c., &c., and thus bring the weights of these engines to 70 tons less than they would have been, had they been made on the common beam principle; and thereby also effect a very important saving of space in the length of the engine room. These engines are fitted with a contrivance (which is protected by patent) for warming the feed water on its passage to the boiler, by causing it to pass through a number of copper pipes around which the spent steam from the cylinder circulates, on its way to the condenser; by which means the temperature of the feed water is elevated about 60 degrees above the usual temperature, at which it enters a boiler, and a saving effected in the consumption of fuel of seven per cent.

There are four copper boilers for supplying the above with steam, made entirely of copper, and placed in pairs, back to back, with a fore and aft stoke hole; these boilers are clothed on the system first used by Messrs. J. and S. Seaward and Capel, and since introduced into the navy for Her Majesty's steam ships, for the prevention of the radiation of heat; the advantages of which were evident in the surprising coolness of the engine room. A barometer placed against the side of the boilers only rose to 68°, and another in the stoke-hole to only 72°.

The boilers are fitted with a patent apparatus for detecting and indicating the state of saltness of the water in the boiler; and also with a receiver and apparatus for blowing out, when the time for that operation has arrived; by means of which all danger from salting the boiler, or blowing out the water too low, is entirely obviated; and the boiler may be worked as long with salt water as with fresh.

There are coal boxes placed on each side of the vessel the whole length of the engine room, and holding when full about 450 tons of coals. The consumption of fuel by actual weight (the coals being weighed during the trial) was 17 cwt. per hour, equal to 6 lbs. of coal per horse per hour.

The "Cyclops" is commissioned by Post Captain Austin, late of the Medea, being the only steam frigate in the navy besides the "Gorgon," of that rank. Her engine room crew will consist of four engineers, twelve stokers, and four coal trimmers.—The actual number of hands including officers and a lieutenant's party of marines, will be two hundred and ten men.

Her dimensions are as follows:—

	Feet.	In.
Extreme length - - - - - - -	217	9
Length of upper deck - - - - - -	195	2
Width across paddle-boxes - - - - -	57	0
Length of engine room - - - - - -	62	0
Width of beam - - - - - - -	38	0
Depth of hold - - - - - - -	23	0
Engines—Diameter of cylinder - - - - -	0	64
Length of stroke - - - - -	5	6
Diameter of paddle-wheel - - - -	26	0
Width of wheel - - - - -	8	0

Weight of engines, boilers and water 280 tons.

Weight of coals for 25 days consumption, 450 tons.

Draught of water with all her guns, ammunition, engines, coals and stores for six months, 16 feet 6 inches.

Tonnage, 1,200 tons.—Power of engines, 320 horses.

The armament of the "Cyclops" will consist of—on the upper deck two 98 pounders; one at the stem, and one at the stern.—Four 48 pounders.

On the gun-deck, sixteen long 32 pounders.

RUSSIAN WAR STEAMER, "PYLADES." AND "THE SONS OF THE THAMES."

THIS vessel is the last of three which were ordered for the Russian government, and of which the two others have already proceeded to their destination.. She went down the river on Wednesday the 18th ultimo, on an experimental trip to Gravesend, accompanied by the Russian Consul and a large party invited by Messrs. Miller and Ravenhill, the engineers who manufactured her machinery, to witness this first trial of her engines, we repaired to Blackwall a little before 11 o'clock (the intended hour of departure), and found that the Pylades had not yet left the docks, and that some time would still elapse before she could be out into the river, in consequence of a large vessel being then on the point of entering the docks. This delay afforded us an opportunity of observing the form of the steamer's hull, which was built by Mr. Pitcher, from drawings by Mr. Ditchburn, to whose talent as a naval architect, the model, if we may judge from the part which appears above water, does great credit.

During this time our attention was directed to a small iron steam-boat, built by Mr. Ditchburn, and fitted with a pair of engines of 28 horse power each, by Messrs. Miller and Ravenhill. She was also going down to Gravesend on her first trial, and while waiting for the Pylades she made several trips in front of the dock entrance to the admiration of all present. She was evidently going at a great speed, but seemed at the same time to cleave the water with such ease as to cause no disturbance whatever in the fluid for there was neither spray nor any perceptible wave against her bows, which speaks strongly for the correctness of the principles followed by Mr. Ditchburn in laying off her lines.

As soon as the Pylades could be got out of the docks, which was not until about 12 o'clock, we proceeded down the river, but owing to some little adjustments which it was discovered were still required to be made in the engines, in order to allow them to work up to their power, the performance was not so good as could be wished, notwithstanding which the engines worked very smoothly, causing little or no vibration in the vessel. The time of running the measured mile at Long Reach was noted on our way down with the tide, but against a rather strong head wind: the distance was performed in 5 min. 47 sec., which gives a speed of nearly 10½ miles an hour over the ground. To ascertain the rate through the water it would be necessary either to deduct or eliminate the velocity of the tide: but, as the engines were not working up to their speed, it was not considered worth while to make the experiment against the tide, so we went on to Gravesend, where we arrived a little before 2 o'clock, and found the "Sons of the Thames" waiting for us. As it had been arranged that the whole party should return to Blackwall on board that boat, she was brought along side of the Pylades, and took the company on board, by which time it was 20 minutes past 2 o'clock; we then started, the Planet, belonging to the Star Company, having left the pier a quarter of an hour before. In the course of one hour we overtook her, and, having gone a little farther, we put about and returned some distance to take a gentleman on board, and passed the Planet again before we arrived at Blackwall, having in the mean time gone completely round her. It is calculated that, in order to do this, we must have been going at the rate of 13½ to 14 miles an hour through the water. This comparative speed with the Planet is the more astonishing as the "Sons of the Thames" has two engines of only 28 horse power each, whilst the Planet has two engines of 40 horse power each.

It may not perhaps be generally known that the iron steam boat, the Orwell, now running between London and Ipswich, which we believe equals, or even excels the "Sons of the Thames" in speed, was also fitted with engines by Messrs. Miller, Ravenhill and Co., and built by Messrs. Ditchburn and Co., so that we may confidently look forward to the time (which we believe not to be far distant), when the speed of our steamers on the Thames shall not only come up to, but even exceed that said to be attained in America, and that with a comparatively small expenditure of power; for if it is not notorious, it is at least known in this country, that the power put into the American steam boats is most gigantic.

New Iron Steamer.—On Saturday the 7th ult., the iron steamer "Enterprise," built and fitted out by Mr. Borrie, of the Tay Foundry, started on a trial trip to Newburgh. The model of the hull is certainly beautiful, and at first sight any one must be of opinion that the elements of form calculated to promote rapid sailing are possessed by the "Enterprise" in a very eminent degree. The entrance and runs are very sharp, which, united with the great bearing in the floors render the vessel buoyant, and secure an easy passage through the water. The anticipations formed of her speed were fully realized. She sailed a measured distance of four miles marked on the shore in the space of 12 minutes. The tide was in her favour, and admitting it to have been running at the rate of four miles an hour (although it was under that rate) would make the actual distance performed by her over the ground at the rate of 16 miles an hour, a speed that has not hitherto been attained by any steamer. It may be remarked that this speed is not so much attributable to the great power of the engines as to the form of that part of the hull immersed in the water; and indeed Mr. Borrie states, that in making his calculation for procuring a given speed, he placed a greater reliance on lessening the resistance that would be experienced by the vessel in passing through the water for obtaining a high velocity, than by dependence on great propelling power. In this he has decidedly succeeded, as the result amply proves. The vessel measures 280 tons, and has two engines of 35 horse power each, which is a power much less in proportion to the tonnage than that of many steamers which would not sail 10 miles an hour, and at the same time having a sectional area of resistance not greater than that of the "Enterprise." A striking feature in the "Enterprise" is the consumption of smoke. This is effected by a plain and very simple contrivance in the interior of the furnace. The furnace bars instead of being straight are curved on the upper surface, and are so adjusted in the furnaces as to form a very acute angle with the front of the boiler at the furnace doors, whilst towards the posterior extremities they are horizontal, in other respects they are similar to those in general use The furnace covers deflect about 18 inches into the furnaces, within two feet of the inner end, which forms a water chamber. The distance between the upper surface of the coals when the furnaces are fully charged, and the under surface of the deflector, is about six inches. The coals for every new feed being deposited in the anterior part of the furnace, which is fully two-thirds longer than the posterior part or space behind the deflector, it follows that the coals before requiring to be pushed back into the space behind the deflector must have become very highly ignited and the component parts which cause the emission of smoke entirely disappear. Then the posterior fire chamber being always charged with fuel which only emits a pure and intense flame, the smoke arising from the coals in the anterior chamber having to pass underneath the deflector come immediately into contact with the flame in the posterior chamber, and having to pass through in its way to the flues is exposed to its most intense action, whereby it is immediately consumed. The dimensions of the "Enterprise" are,—Length of keel, 116 feet; breadth of beam, 21 feet; depth of hold, 8 feet.—*Dundee Courier.*

Steam Navigation across the Atlantic.—Early next spring, and during the year, there will be placed on the several lines three new steamers to ply between England and New York, and Mr. Cunard's steamers to Boston, by the way of Halifax, will go into operation. Two of the three, the *New York* and *President*—the former for the Transatlantic Company, and the latter for the British Queen Association—are nearly ready for launching; and the *New York* will probably leave England in April or May, and the *President* in Jun or July. The third is now building for the Great Western Company, andwil be constructed of iron. She will not be ready before next September or October. These, together with Mr. Cunard's, which will commence running in May next, will keep open a free communication with Europe without the aid of "windy" vessels. Together, they will form a line so that there will be two departures from England and two from the United States every month. In addition to these, the keel of another steam ship, to be of 1,450 tons, and 450 horse-power, has already been laid for the Transatlantic Steam Company, to run in connection with Liverpool and New York. She will not be finished before the spring of 1841; and also by that time there will be two large and splendid steamers ready to start from the Clyde, and run across to New York. With steamers, as with sailing packets, the builders improve with every new vessels. It it said by those who have seen the plans of the new steamers, that the improvements adopted will place them on a par with our packet-ships in point of comfort, &c. The Atlantic will soon be as thickly dotted with steam-ships as with sailing vessels.—*New York paper.*

Port of Fleetwood.—The commissioners from the Court of Exchequer, sent down for the purpose of surveying and setting out the boundaries of the Port of Fleetwood, finished their task yesterday se'nnight. They commenced on the previous Monday to survey the coasts and creeks between Lancaster and Preston, and determined the limits of the port as follow:—To commence at a run of water called the Hundred End, about two miles to the west of Hesketh Bank, continuing up to Preston, thence along the coast on the north side of the river to Lytham, round the coast to Blackpool, and on to Fleetwood; thence to the river Broadfleet, four miles from Sea Dyke, including both sides of the Wyre, and the river Broadfleet.—*Preston Pilot.*

The British Queen is not intended to be started for New York on the first of January, as previously advertised, the proprietors being of opinion that one very serious impediment to the speed of the vessel is in the inferior construction of the paddle-boxes; and, accordingly, a new description of paddle, called "The Reefing Paddle," is about to be substituted—this new paddle being the invention of the celebrated Mr. Samuel Hall.—*Midland Counties Herald.*

ENGINEERING WORKS.

The Hull Dock company are about applying to Parliament for making an extensive dock and entrance for the large class of steam boats, &c. on the east side of the river Hull.

Woolwich Dock-yard.—In the November number, we inserted a paragraph from the "Times," stating that the new dry dock, making at Woolwich, and other works, were under the charge of Lt. Dennison; upon enquiry, we find that the new dry dock now on hand at the east end of the yard, is being constructed under the direction and superintendance of Mr. Walker, by Messrs. Grissell and Peto.

New Pier at Margate.—This pier, which is intended to rival that of Ramsgate, as a refuge harbour for her Majesty's steam-vessels, &c., is, we hear, to commence at the Wayland and Fulsam rocks, from the facility arising from their receiving the piers on a foundation of solid chalk, extending 1000 feet from the gateway to the sea at Westbrook. The second point, opposite the fort, next the East Cliff, is intended to be 500 feet, leaving an opening for vessels to the extent of 400 feet.—*Advertiser.*

Cowes.—It is now expected that Sir John Rennie's plan for deepening the Medina will be carried into execution. A spacious town-quay will also be erected, and it is rumoured that the members of the Royal Yacht Squadron are about removing their rendezvous from this place to the anchorage off Norris, on which estate a splendid club-house is to be built for the accommodation of its members.—*Hampshire Telegraph.*

Proposed new road from Perth to Elgin.—A meeting was lately held at Elgin on this important subject, when a number of proprietors and gentlemen of the town attended, including the Duke of Richmond. Mr. A. Mitchell, civil engineer, Perth, attended with a report he had drawn up on the subject, as to the probable expense, &c. of the new line. The estimates, framed on a minute survey he calculated would not exceed £23,000. The probable revenue to be derived from tolls, Mr. Mitchell estimated in all at £1530. After Mr. Mitchell's statement and report, the meeting passed a series of resolutions, appointing a committee to prepare a memorial to Government soliciting pecuniary assistance, as also the aid of the members of Parliament connected with the northern counties and burghs.

Shoreham Harbour.—The new pier at the entrance of the harbour has been carried a considerable distance into the sea, and though it will doubtless improve the harbour, it checks the travelling on the beach between Brighton, and in case of high tides may occasion considerable inconvenience.—*Brighton Herald.*

Teignmouth Bridge, Devon.—It may be fresh in the recollection of our readers that a very considerable portion of this bridge suddenly fell in June 1838, caused by the destruction of the timber piles from the ravages of the worm. The restoration was only commenced in the early part of the autumn, by direction of Her Majesty's Commissioners for Exchequer Bill Loans, from the plans of Messrs. Walker ahd Burges. If we may judge from the progress already made, and the number of workmen employed, there is every prospect of the bridge being again made passable to the public in the course of a couple of months. We regret having omitted noticing this work before, as we attach greater interest to works of this description (after failure) than in the first construction. We hope again to refer to this subject with a more detailed account of the plans adopted.

PROGRESS OF RAILWAYS.

Grand Junction Railway.—A good deal of inconvenience and trouble were occasioned a few days ago to the passengers on the railway, and the servants of the company, by "a slip" or fall of a great portion of bank, about seven miles on this side Birmingham. At that point there is a very deep cutting, the bank on one side of which, having been loosened by the late incessant rains, was shaken down by the passing of the six o'clock train, on Saturday morning last. The engine was partially covered by the mass of earth, but providentially no injury was sustained by any of the passengers. Another engine was obtained to forward the train, which was, of course, delayed considerably beyond its usual time, as were also the other trains which followed; the passengers and luggage having to be transferred from one train to another before they could proceed, both lines of rails being entirely covered with a vast quantity of earth. We understand that the line was not cleared so as to allow of the passage of trains until Monday.

Great Western Railway.—The works of this railway, between Dudast and Farringdon, are so far advanced, that we understand the directors confidently expect to open the line nearly thirty miles beyond Reading, about the same time as to that town itself: in which case, upwards of sixty miles of the London division will be open for public use in the spring, and the line between Bristol and Bath at the same time.

North Midland Railway.—The contracts for the Eckington, Chesterfield, and South Wingfield stations have been let to the following parties:—Eckington, to Messrs. Smith and Brown, of Sheffield; Chestorfield, to Messrs. Leather and Waring; South Wingfield, to Mr. Radford, of Alfreton. Total amount, £7,000. The Belper contract is not yet let.—*Derby Reporter.*

Hull and Selby Railway.—On this line all the works continue to be prosecuted as rapidly as the very unfavourable weather allows. About two-thirds of the whole of the iron work of the superstructure of the bridge over the river Ouse, at Selby, are now on the spot, and the men are busily engaged in fixing it; the whole of the ironwork of the bridge over the river Derwent, near Wressel Castle, has arrived there, and two of the ribs are fixed across the river, the greatest portion of the entire length of the railway is ballasted, and the contractors are busily engaged in laying the permanent way. We understand that it is highly probable this railway will be completed by Midsummer next, and that in the course of the year, there will be a complete railway communication between Hull and London.—*Midland Counties Herald.*

Glasgow and Ayrshire Railway.—It is truly gratifying to find that the highest anticipations formed of the success of this railway, promise to be fully realized, as a traffic on the limited portion of the line already opened is being created, far more extensive than the most sanguine could have expected. Indeed, this undertaking affords a more than ordinary illustration of the fact, that facility of communication secures traffic for itself. Before the line was opened to Irvine, the intercourse between these places was so very limited, that public accommodation did not demand more than a one horse coach, thrice a week. Now, however, that railway coaches run to and from Irvine thrice a day, and there is a coach stationed at Irvine to carry forward passengers to Glasgow, this route has become quite a thoroughfare. And well do the shareholders of the Glasgow and Ayrshire Railway merit so flattering a prospect of the success of a speculation fraught with such unspeakable advantages to the west of Scotland. The recent return of the number of passengers that have travelled from Ayr to Irvine, during the three months ending the 5th current, (36,832) must give them great confidence, that when the entire line to Glasgow is opened, the traffic upon it will greatly exceed the estimate laid before parliament. Indeed, we believe that the parliamentary proof went no further than to warrant the *annual* traffic in passengers of 32,000, 4,832 less than have already travelled in three months! The line from Irvine to Kilwinning being now on the eve of completion, will be opened in January next, when a large increase of traffic must necessarily follow, from the surrounding populous districts, including the towns of Dalry, Kilbirnie, Beith, Stevenson, Saltcoats, Ardrossan, &c. The entire line to Glasgow, as is now pretty well known, is expected to be opened in June, 1840.—*Ayr Advertiser,*

North Midland Railway.—The Leeds station, or terminus, we understand, is to be let by contract to-morrow. The Belper station, we hear, is to be built by Hugh M'Intosh, Esq. The bridge for the turnpike road, near Duffield, already known as Moscow-bridge, is nearly completed. Milford tunnel is completed, the last brick remaining only to be laid. The enormous mass of masonry at Belper is rapidly progressing, and the temporary bridge over the wide part of the Derwent, called Belper-pool, is taken up, and the permanent one, nearly 600 feet long, promises to be complete before New Year's Day. The new bed for the river, near Amber-gate, is proceeding with great activity; and the immense bridge of five arches, at the same place, promises completion soon, as we observe centres fixing for the arches, the greater part of two years having been spent, night and day, in getting in the foundations and piers. On the embankments in this neighbourhood, great portions of the permanent way are laid. The difficult undertaking at Bull-bridge, in passing over the turnpike road and under the bed of the canal at the same time, has been easily accomplished, and is all but finished. We observe here water and land piled four stories, one on the other, in a singular manner, thus:—there is first the river Amber, over which goes the turnpike road; over this goes the North Midland Railway; and over the railway flows the Cromford canal. Such a complication of bridges is seldom to be met with. At the station here (Derby) the greatest activity prevails; and there is every indication of an early opening of this line in the spring. A committee of directors, with R. Stephenson, Esq., arrived here by a special train on Monday last, to inspect the works.—*Derby Reporter of Thursday.*

Gloucester and Birmingham Railroad.—The works of this railway, in the neighbourhood of Cheltenham, continue to progress most satisfactorily. The extensive range of buildings near the offices and lodge, already erected, which are designed for the engine-houses, workshops, &c., of the depôt, are in a very forward state, and, unless retarded by the weather, will be all roofed over in the course of a few days. A powerful locomotive engine is now constantly employed in removing ballast, &c., along the line between Cheltenham and Tewkesbury, which portion is so far ready for use, that it is the intention of the directors to make their first experimental trip along it some day next week. The ultimate prospects of this company seem to be most promising.—*Bristol Mercury.*

Eastern Counties Railway Company.—The bridge built by this company over the brook leading from Brentwood to Warley is now finished, and persons travelling that way will find the hill considerably lessened.—*Chelmsford Chronicle.*

Croydon Railway.—The first six months from the opening of this line terminated on the 4th inst.; during that period 311,319 passengers have travelled on the railway, and the money received is £17,666 11*s.* 3*d*,—*Sun.*

Blackwall Railway.—We understand that the Directors have determined upon fitting up an electro-magnetic telegraph along their line, similar to that which we recently noticed as having been for some time in successful operation on the Great Western Railway. In addition to the facilities which such an arrangement will afford in the working of the railway, (an arrangement peculiarly adapted to this line, as we shall take a future opportunity of showing,) the public will be benefitted in no small degree by its application to other purposes. For instance, a vessel coming up the river can, before reaching Woolwich, easily communicate by signals with the railway terminus at Blackwall, and the information being instantaneously conveyed to the Fenchurch-street station, in the immediate vicinity of the great seat of business, parties who are expecting the arrival of friends will at once be prepared to meet them in town, without the necessity of waiting for hours about docks and wharfs; or, if so inclined, can join them at Blackwall, almost as soon as the vessel has reached that point. In the case of steam-boats especially, this will be of great advantage as there can be no doubt that the whole of the passengers by these vessels will at once avail themselves of the railway to avoid the always tedious, and sometimes dangerous, navigation of the Pool. We are glad to find that the works of this short but most important line are proceeding with much vigour, and that the prospects of the Company are in the highest degree satisfactory.—*Railway Times.*

London and Brighton Railway.—Since the opening of the tunnel on the Shoreham branch of the railway, the cutting on New England Farm has made rapid progress; and judging from the appearance of the works, we should suppose that two or three weeks would be sufficient to complete it. The remainder of the line, at the Shoreham end, will, we imagine, take even less time, as only a very few yards of embankment remain to be made, and the permanent rails are already laid on the level of the meadows immediately contiguous to Shoreham. A great number of spectators assemble at New England daily, to witness the ingress and egress of the engine to and from the tunnel. The viaduct over the New England Road, for the London line, is nearly completed; and the progress of the works there, is, we learn, equally rapid and satisfactory with that of the works on the Shoreham Branch, nearer home.—*Brighton Gazette.*

Great Western Railway.—The progress of this immense national undertaking is beginning now to be a work of admiration. Betwixt London and Bristol there are many points of observance showing the wonderful daring results of science which our forefathers never could have anticipated. The wonders of Egypt dwindle into nothing in the comparison. There are gigantic labours without use, the monuments of pride and folly; here use, ornament, and durability seem to try to surpass each other, and their several excellences are so adjusted as to show the foundation of future national prosperity beyond all power of calculation—not only the prosperity of trade by the rapid conveyance of merchandise, but intellectual prosperity, national progress as to mind, by bringing all parts of the empire into more frequent intercourse with large towns, and especially with the metropolis. The most costly portion of the line will be the tunnel at Box. This will ever be in itself a magnificent proof of the skill and enterprise of the age; but these can never be truly estimated, without a knowledge of the overwhelming difficulties encountered in its progress. Of these no evidences will be presented by the work itself, they will be matters only of history. The company deserve high approbation if not national gratitude for their liberal endeavour to make every point of observance an additional beauty to its locality. Even in Bath, the most beautiful city in England, where every thing seems to harmonise in splendour, even here we find the line of works adjacent adding to the general magnificence. The centerings of the arch over the Wells-road, at the bottom of Holloway, have been removed, and erected at the place where the railway will cross Claverton-street. The arch and the two gothic towers are pronounced to be excellent specimens of workmanship; and the entire viaduct, from the taste evinced in its design, will form, when completed, quite an ornament to the neighbourhood. The coffer dam in the Avon, in which the middle support of the proposed bridge will be erected, has not yet been cleared of water, but every effort is being made to effect that object. At the tunnel near Bathwick-terrace the workmen have commenced the formation of a permanent way; and near Hampton-row great advance has been made during the last five or six weeks. At Hampton and the fields beyond, the cuttings and embankments are in a forward state. Close by the stone bridge, between Hampton and Bathwick, the works are also beginning to alter the face of the landscape.—*Bath Journal.*

South Eastern Railway.—The rapid progress of the works is giving quite a lively aspect to Folkestone. The bridge across the Canterbury and Dover road is also completed; and the advancement of the line on either side is going on in a highly satisfactory manner.—*Dover Chronicle.*

Leeds and Manchester Railway.—Rapid progress is making in the construction of the tunnel at the summit between Littleborough and Sodmordon, and it is generally expected that the whole line will be completed in the autumn of the year 1840. The number of passengers now travelling in the railway carriages between Manchester and Littleborough is perfectly amazing and approaches nearly to 3,000 a day; nor is this to be wondered at, when it is considered that it is actually cheaper for a labouring man to ride upon the railroad than to walk upon the highway, as the journey of thirteen miles is performed in half an hour by steam, which would require four hours for a foot passenger, and the fare for travelling in the stand-up-carriages amounts only to one penny a mile.—*Derby Reporter.*

NEW CHURCHES, &c.

Warwickshire.—A new Church is about to be erected at Attleborough, in the parish of Nuneaton, on a site the gift of the Earl of Harrowby. There are upwards of three acres and a half of land, which it is his lordship's wish should be laid out advantageously for the benefit of the clergyman, and it is in contemplation, reserving sufficient for the church, burial ground, parsonage house, croft and schools to form a street of comfortable dwelling houses, the proceeds of which are to form part of the endowment. It is designed by Mr. Thomas L. Walker, in the early pointed style, with a handsome triple west window, and a small tower at the south west angle, containing a clock-room, belfry, ringer's floor, and a staircase leading to a west gallery. At the east end is a semicircular apsis, on each side of which, against the east wall of the church, the pulpit and reading-desk are placed. It is cruciform in plan, a robing-room and a porch forming the arms of the cross. The dimensions of the body, inside the walls, are 73 feet by 39 feet, and is calculated to accommodate 472 persons, viz. 112 in pews, and 360 on benches.

All Saint's Church, Spicer Street, Mile End New Town.—On the 25th of November this church, erected and endowed at the expense of the Metropolis Churches Fund, was consecrated by the Bishop of London. It is designed in the Norman style by Mr. Thos. L. Walker, and has a tower, situate on the south side, tabled off and terminated in a neat square bell turret with an octagonal roof. The body of the church measures 74 ft. 6 in. by 54 ft. 6 in. in the clear inside; the roof is in one span, with a queen truss open to the straining piece, it is slightly ornamented, and the timbers are chamfered; the tie-beams are supported by brackets springing from ornamental stone corbels. The pulpit, designed it is presumed to imitate stone, by the details made use of, is rather inappropriately grained heart-of-oak; it is chaste in style, open underneath to admit of an entrance into the reading-desk. The altar piece is cleverly managed, at a small expense, by arched recesses being formed in the brickwork, wherein the Commandments, the Lord's Prayer, and the Belief, are written in appropriate but perfectly legible characters, the initial letters in red and blue, the rest in black on a stone-coloured ground. The chancel is lighted, not from the east as usual, but from the north and south; by this means the glare, which often proves distressing to the congregation, while regarding the preacher, is avoided, while the rays of light, falling upon the altar table from the south, during the greater part of the day, must tend to produce a pleasing effect. Attached to the Church is a spacious vestry, 24 feet by 16 feet, with a neat Norman fire-place executed in Bath stone, and is provided with coal-cellars, &c. There is accommodation for 1110 persons; the church and vestry were contracted for by Mr. West, of Cannon Street Road, at £4095.

New Churches in Wolverhampton.—On Friday, 22 Nov., the plans for a new church in Horsley Fields, one of the intended three new churches in Wolverhampton, were submitted to a meeting of subscribers, in the large room in the Swan Hotel. The plans were 21 in number, and many of them very elegant designs: they were all in the Gothic style. Five of them were selected for further consideration, and were exhibited to the subscribers at large, at the same place.—*Staffordshire Advertiser.*

PUBLIC BUILDINGS, &c.

Warwickshire.—An extensive Hospital, or range of almshouses, is in course of erection at Bedworth, near Coventry, from the designs and under the superintendence of Mr. Thomas L. Walker. The main building forms three sides of a cloistered quadrangle, which sets back 90 feet from the street; towards the street, on the right hand is a porter's lodge, and on the left a tenement to correspond, each with a neat oriel window, leaving the quadrangle open to view, and an iron palisade, with ornamental brick piers and stone caps, complete the street frontage. It is calculated to lodge 40 pensioners, 20 male and 20 female, each having a separate bedroom and pantry; a sitting-room is provided for every two. In the centre of the quadrangle is a spacious dining-room for the governors of the charity, a committee-room, a steward's office, and a kitchen, with accommodation for a nurse. The dining-room is in the form of the ancient halls, and has four bays attached to it; the porch occupies one, the butler's pantry another, and the two others are open to the room; an ornamental screen at the lower end parts off the passage leading from the porch to the committee-room, &c.; over the two front bays are strong-rooms for deeds, one opening into the steward's office, the other is ascended by a circular stone staircase from the hall itself. From the roof of the hall rises an ornamental bell turret, and clock-room in the form of an ancient Louvre. The whole is designed in the late Gothic style, the windows being square-headed, with mullions and transoms, except those of the hall, which are four-centre-pointed, with mullions and tracery. The whole is to be faced with red bricks, and to have stone dressings to the doors and windows and stone motings. Mr. John Toone, of Leamington, is the contractor for all the works, except the hall roof and clock turret, at £8,500.

Llankovery, Carmarthenshire.—The committee appointed to examine and report upon the designs for a market, met in accordance to an advertisement offering a premium for the best design, have adopted the design of G. Clinton, architect of Cardiff.

MISCELLANEA.

EFFECTS OF LARGE FIRES IN PREVENTING STORMS.

(Translated from the French.)

M. Matteucci had pointed out the practice recently introduced into a parish of Romagna of lighting large fires for the purpose of preventing the formation of storms, and remarked that during three years that this practice had been adopted, the parish, which until then had every summer been ravaged with hail, had been spared, while the neighbouring parishes had not escaped.

M. Arago, when quoting this fact in his notice upon thunder, (*Annuaire du Bureau des Longitudes,* 1839), remarked that such short experience would not allow us to consider the result conclusive, and added that more exact data would doubtless be obtained on this subject, by comparing with those of the neighbouring agricultural districts, the meterological observations of certain districts in which high chimneys and large factory fires are used are very numerous. This comparison, said he, had been already made in England, but the results although in favour of the preservative influence of large fires, did not show this influence free from doubt. In fact high furnaces in England are particularly numerous, where there are many mines; the rarity of storms therefore in these places may just as well be attributed to the nature of the soil as to the action of the large fires, which are required for the reduction of the minerals.

M. Matteucci has now pointed out another locality in which this influence of metallic veins is not mixed up with that of large fires. While travelling in the Apennines, he found that those districts in which charcoal and sulphur are prepared, are not much subject to storms, and are free from hail. He was told that about five years ago a hail storm burst over the parish where the sulphur furnaces are, but the place where they are established was preserved. The place mentioned here is Perticaja, near Rimino, where there is a number of these furnaces.

Mr. Cockerill's Manufactory.—Advices from Liege state that Mr. John Cockerill has set out for St. Petersburgh, taking with him one of the chief persons employed at his works, and three engineers. The Emperor Nicholas, it is added, has advanced Mr. Cockerill 10,000,000f. at 5 per cent. secured on all his establishments in Belgium, Russia engaging to purchase annually, to a certain amount, machinery to be manufactured in them, which is to diminish annually, as the Emperor, assisted by Mr. Cockerill, shall have created similar establishments in his own dominions.—*Midland Counties Herald.*

Rouen.—A design for a tomb to receive the heart and statue of Richard Cœur de Lion, in the style of the 12th century, has been prepared by M. Deville, conservator of monuments in the Cathedral of Rouen. It is proposed to place it in the Chapel of the Virgin in the cathedral, near the tomb of Cardinal d'Amboise; and it is supposed that the execution of it will begin before the end of the present year.—*French paper.*

Encroachment of the Sea.—The sea, it is said, is encroaching upon every part of the Cornish coast. In the memory of many persons still living, or but lately dead, the cricketers were unable to throw a ball across the Western Green between Penzance and Newly, which is now not many feet in breadth, and the grandfather of the late vicar of Madron is known to have received tithes from the land under the cliff of Penzance. At a very remote period, we are assured by tradition, that a considerable part of the present bay especially that comprehended within a line drawn from near Cuddon Point, on the east side, to Mousehole on the west, was land covered with wood, but which, by an awful convulsion and irruption of the sea, was suddenly swept away. There is a letter extant, written in the reign of Charles II., to the then proprietor of an estate, which included part of the Western Green, and that part is there estimated at 36 acres of pasturage.—*Penzance Gazette.*

Egypt.—Machines have been brought from England to drain the marshes at Alexandretta, where the stagnant waters fill the country with malaria. The same cause propagates fever in the Egyptian army at Marasch, Adana, and other places. The hospital service is very badly arranged.

Royal Belgian Steamers.—The Belgian Government, in the budget of the Minister of Public Works, alluding to the marine, notifies that "a separate project will be submitted to the Chambers to meet this expense, whether by means of a transfer, or by means of a special credit, destined to complete the system of the railroad by some steam-boats." This measure of M. Nothomb, which is considered, even by the leaders of the Opposition, to be the ablest one projected since the settlement of the country, is the favourite of M. de Theux, and said to be impressively sanctioned in the highest quarter.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 2ND DECEMBER TO 24TH DECEMBER, 1839.

George Davey, of Llandudno, County of Carnarvon, Mining Agent, for "*an improved mode of applying water-power*."—Sealed December 2; six months for enrolment.

Luke Hebert, of Birmingham, Patent Agent, for "*improvements in the mechanism and process of packing and pressing various articles of commerce*." Communicated by a foreigner residing abroad.—December 2; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in machinery or apparatus for making or manufacturing pins and sticking them in paper*." Communicated by a foreigner residing abroad.—December 2; six months.

Godfrey Anthony Ermen, of Manchester, Cotton Spinner, for "*certain improvements in machinery or apparatus for spinning, doubling, or twisting cotton, flax, wool, silk, or other fibrous materials, part of which improvements are applicable to machinery in general*."—December 2; six months.

John Evans, of Birmingham, Paper Maker, for "*improvements for chemically preparing and cleansing of felts used by paper manufacturers*."—December 2; six months.

Henry Dunington, of Nottingham, Lace Manufacturer, for "*improvements in machinery employed in making frame work knit, or stocking fabrics*."—December 2; six months.

James Guest, Junior, of Birmingham, Merchant, for "*improvements in locks and other fastenings*."—December 2; six months.

George Saunders, of Hooknorton, Clerk, Oxford, and James Wilmot Newbery, of the same place, Farmer, for "*improvements in machinery for dibbling or setting wheat and other grain or seed*."—December 2; six months.

Henry Trewhitt, of Newcastle-on-Tyne, Esq., for "*certain improvements in the fabrication of china and earthenware, and in the apparatus or machinery applicable thereto*." Communicated by a foreigner residing abroad. December 4; six months.

Christopher Nickles, of York Road, Lambeth, Gentlemen, for "*improvements in propelling carriages*." Communicated by a foreigner residing abroad.—December 4; six months.

Pierre Narcisse Cronier, of Fricourt's Hotel, Saint Martin's Lane, for "*improvements in filters, and in the means of cleansing the same, and for separating, colouring, and tanning matters for filteration, and for improvements in employing such tanning matters by filteration*." Partly communicated by a foreigner residing abroad.—December 4; six months.

James Mayer, of Ashley Crescent, Saint Luke, Gentlemen, for "*an improved machine for cutting splints for matches*."—December 4; six months.

George Lowe, Engineer to the Chartered Gas Company, and John Kirkham, Engineer to the Imperial Gas Company, both of London, for "*improvements in the manufacture of gas for purposes of illumination*."—December 4; six months.

James Nasmyth, of Patricroft, near Manchester, Engineer, for "*certain improvements applicable to railway carriages*."—December 4; six months.

John Heaton Hall, of Doncaster, Chemist, for "*improvements in preserving and rendering woollen, and other fabrics, and leather waterproof*."—December 5; six months.

Harrold Potter, of Manchester, Esquire, for "*certain improvements in printing calicoes, muslins, and other fabrics*."—December 9; six months.

Samuel White, of Charlton, Marshatts, Dorset, Esquire, for "*improvements in preventing persons from being drowned*."—December 9; six months.

Moses Poole, of Lincoln's Inn, Gentleman, for "*improvements in the manufacture of caustic, soda, and carbonate of soda*." Communicated by a foreigner residing abroad.—December 9; six months.

Thomas Richardson, of Newcastle, Chemist, for "*a preparation of sulphate of lead, applicable to some of the purposes for which carbonate of lead is now applied*."—December 9; six months.

John Leslie, of Conduit Street, Hanover Square, Tailor, for "*improvements in measuring the human figure*." Communicated by a foreigner residing abroad.—December 9; six months.

John Juckes, of Shropshire, Gentleman, for "*improvements in furnaces or fire-places for the better consuming of fuel*."—December 9; six months.

Pierre Frederick Gongy, of Tavistock Street, Westminster, Watch Maker, for "*an improvement in clocks, watches, and other time-keepers*."—December 11; six months.

Robert Hervey, of Manchester, Drysalter, for "*certain improvements in the mode of preparing and purifying alum, alumina, aluminous mordants, and other aluminous combinations and solutions, and the application of such improvements to the purposes of manufacture*."—December 13; six months.

Robert Gill Ransom, of Ipswich, Paper Maker, and Samuel Millbourn, foreman to the said R. G. Ransom, for "*improvements in the manufacture of paper*."—December 13; six months.

Angier March Perkins, of Great Coram Street, Civil Engineer, for "*improvements in apparatus for transmitting heat by circulating water*."—December 13; six months.

Jacob Brazill, Governor of Trinity Ground, Deptford, for "*improvements in obtaining motive power*."—December 16; six months.

Henry Seymour Moore Vandeleur, of Kilrush, Ireland, for "*improvements in paving or covering roads, and other ways*."—December 16; six months.

Samuel Walton Faxton, of Park Village East, Regent's Park, Surgeon for "*an apparatus to be applied to the chimneys of gas and other burners, or lamps to improve combustion*."—December 16; six months.

Monnin Japy, and Constant Jouffroy Dumery, of George Yard, Lombard Street, Gentlemen, for "*improvements in rotatory engines, to be actuated by steam or water*."—December 16; six months.

David Morison, of Wilson Street, Finsbury, Ink Maker, for "*improvements in printing*."—December 16; six months.

David Naylor, of Copley Mill, Halifax, Manufacturer, and John Crighton, Junior, of Manchester, Machine Maker, for "*certain improvements in machinery for weaving single, double, and treble cloths, by hand or power*."—December 16; six months.

George Wilson, of Salford, Machinist and Engineer, for "*certain improvements in steam-whistles adapted for locomotive engines and boilers, and other purposes*."—December 16; six months.

John Robinson, of North Shields, Engineer, for "*an improved steering apparatus*."—December 16; six months.

John Wood, of Burslem, Stafford, Manufacturer of Mineral Colours, for "*a new method or process in the application and laying on of the substances used in the printing, colouring, tinting, and ornamenting of china, porcelain, earthenware, and other wares of the same description, by which such wares can be printed and ornamented with flowers and other devices in a much cheaper and more simple and expeditious manner than by any process now in use, and colours of all or any variety may be printed, shaded, mixed, and blended together in one of and the same design or pattern, and hardened or burnt into the substance of the aforesaid wares by a single process of firing or hardening in the enameling kiln*."—December 16; two months.

James William Thompson, of Turnstile Alley, Long Acre, Upholsterer, for "*improvements in the construction of bedsteads, which improvements are particularly applicable to the use of invalids*."—December 16; six months.

William Newman, of Birmingham, Brass Founder, for "*certain improved mechanism for roller blinds, which it is intended to denominate Simcox and Company's patent blind furniture*."—December 16; six months.

Joseph Gibbs, of Kennington, Surrey, Engineer, for "*an improvement or improvements in the machinery for preparing fibrous substances for spinning and in the mode of spinning certain fibrous substances*."—December 21; six months.

George Lindsay Young, of Hackney, in the county of Middlesex, Gentleman, for "*an improved surface for paper, mill or card board, vellum and parchment*."—December 21; six months.

Henry Francis Richardson, of Ironmonger Lane, Gentleman, for "*improvements in omnibuses*."—December 21; six months.

John Cutts, of Manchester, Machine Maker, and Thomas Spencer, of the same place, Mechanic, for "*certain improvements in the machinery or apparatus for making wire cards for carding cotton, silk, wool, and other fibrous substances*."—December 21; six months.

Laurence Wood Fletcher, of Chorlton-upon-Medlock, Manchester, Machinist, for "*an improvement or improvements in the manufacture of woollen and other cloths, fabrics, and in the application of such cloths or fabrics to various useful purposes*."—December 23; six months.

Thomas Firmstone, of Newcastle, Coal Master, for "*improvements in the manufacture of salt*."—December 24; six months.

Alexander Mac'Rae, of the London Coffee House, Ludgate Hill, London, for "*improvements in machinery for ploughing, harrowing and other agricultural purposes, to be worked by steam or other power*."—December 24; six months.

Thomas Hardeman Clarke, of Birmingham, Cabinet Maker, for "*certain improved fastenings for window sashes, tables, and such like purposes*."—December 24; six months.

TO CORRESPONDENTS.

R. H.—*The Marquis of Tweeddale's brick and tile-making machine is patented, and licences are granted for using it in various parts of the kingdom.*

The communication of M. N. O. *will appear next month.*

A Catholic must excuse us for not publishing his last communication.

The Epycycloidal Motion for a Steam Engine is not new.

A lithographic drawing of a Church was received from Norwich by our publisher, but unfortunately it has been mislaid, we were charged 2s. 8d. for carriage and porterage for it, we trust that our correspondent will not in future put us to that expence.

We have been obliged to postpone some important Engravings, which we could not get ready in time, until next month.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, to be directed to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

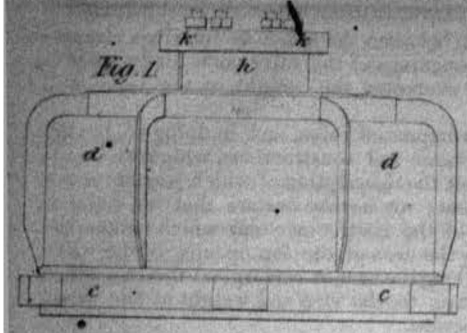
The First Volume may be had, bound in cloth and lettered in gold Price 17s.

⁂ The Second Volume may also be had, Price 20s.

Plate 1.

Harvey & West's Patent Pump Valve.

Fig. 1.



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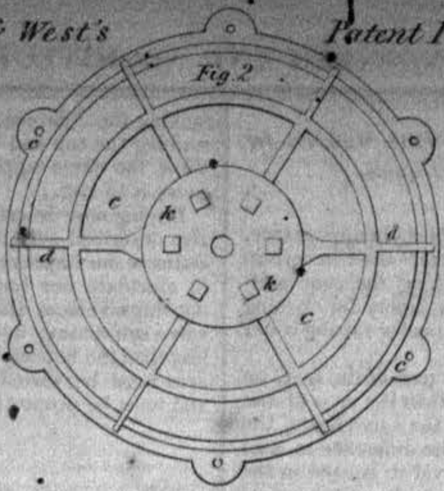

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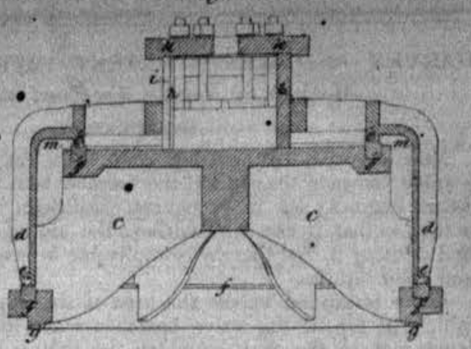

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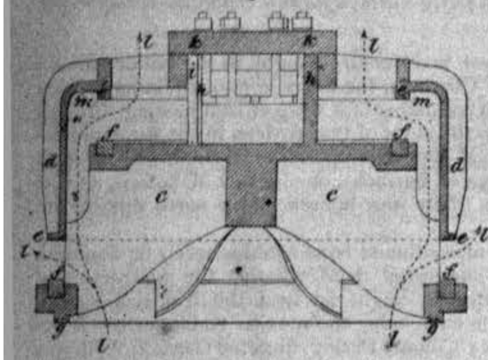

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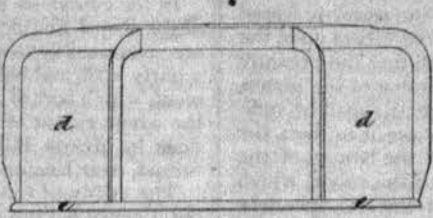

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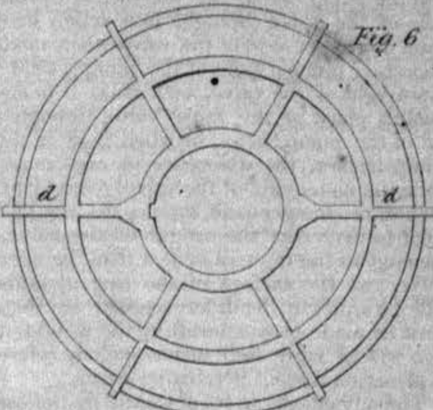

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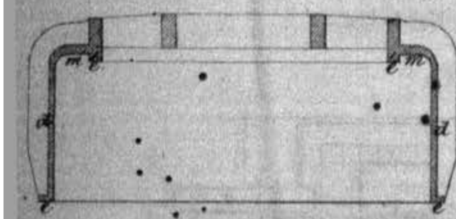

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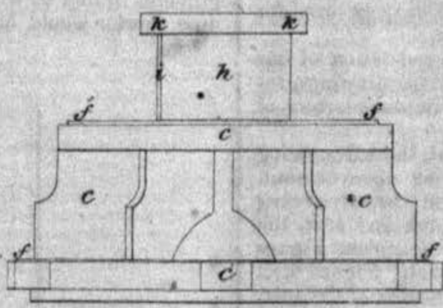

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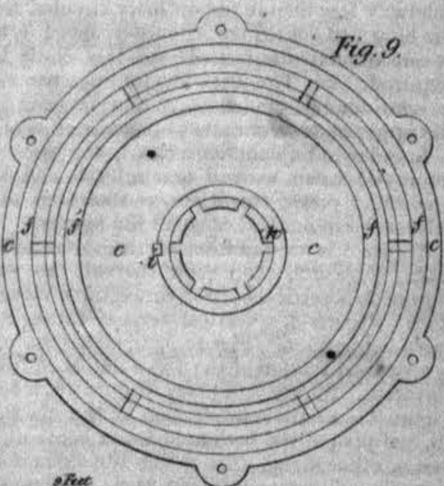

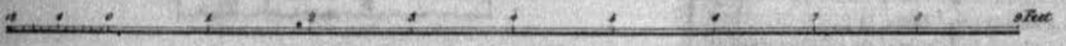

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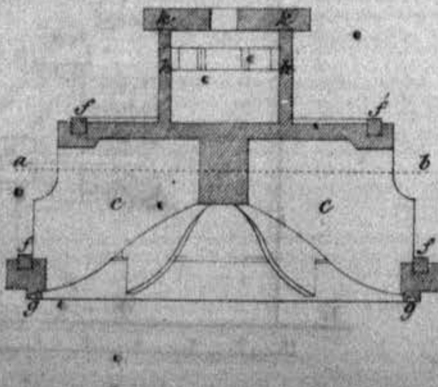

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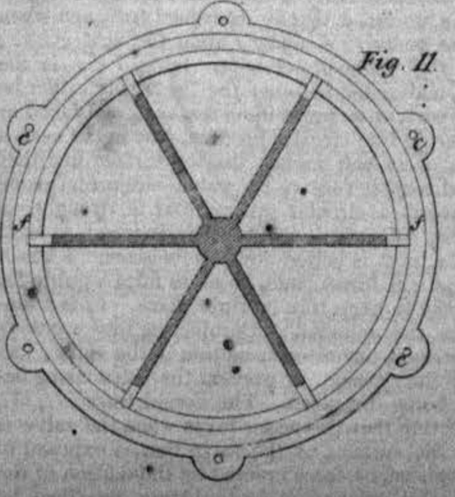


R. Jobbins, Warwick Court

HARVEY AND WEST'S PATENT IMPROVED VALVE *for Machines for Raising Water and other Liquids.*

SPECIFICATION.

Now know ye, that our improved valve resembles, in appearance, a valve known by the name of the "double beat valve," used in certain steam engines; our improvement consists in making the same self-acting, so that it can work without the aid of machinery for opening and shutting it, and thereby is applicable to machines for raising water and other liquids.

In our improved valves the area of the upper part of the seat, on which the top of the valve beats, is made less than the area of the lower part of the seat, on which the bottom of the valve beats, the valve being made of course to correspond, and the difference in area between the two must be such that, when the valve is used in the place of the lower valve in a pump through which the water passes into the pump barrel, the pressure of the atmosphere upon the under side of the valve (brought into action by creating a partial vacuum upon the upper side of the valve when motion is given to the piston, bucket, or plunger-pole of the pump,) shall be sufficient to overcome the weight of the valve, and cause it to rise, and when the valve is used in place of the upper valve, through which the water is forced out of the pump barrel, or when used in lieu of the valves upon the pump bucket, the difference in area must be such that the pressure upon the under side of the valve, (caused by the motion of the piston, bucket, or plunger-pole forcing the liquid through it,) shall be sufficient to overcome the weight of the valve, and cause it to rise; the opening in the top will be less than the opening in the bottom of the valve, and the surface of the ring upon the top of the valve, which will be equal to the difference between the area of the two openings, must be made proportionate to the weight of the valve itself, the action will be more fully understood by reference to the drawings and explanation thereof hereinafter given.

The advantages to be obtained by the use of our improved valve, are 1st, That as the area of the valve exposed to the pressure of the column of water, or action of the piston upon its return stroke, is considerably less than in the ordinary circular, hanging or butterfly valves, the blow and consequent vibration caused by the shutting of the valves, is considerably diminished, and less costly foundations are therefore required. 2d. The loss of water upon the shutting down of the valve is considerably diminished. Our improved valves may be used for the upper and lower valves of all varieties of pumps.

In order to explain more clearly the construction and action of our improved valve, we will now refer to and describe the drawings, representing plans, elevations, and sections of it. The same letters of reference are marked upon all the figures.

Figure 1 is an elevation of the valve and its seat, the valve being shut. Figure 2, a top view thereof, the valve being open or shut. Figure 3, a vertical section through the valve and seat, the valve being shut. Figure 4, a vertical section through the valve and seat, the valve being open. Figure 5, an elevation. Figure 6, a plan. Figure 7, a vertical section of the valve detached from its seat. Figure 8, an elevation. Figure 9, a plan. Figure 10, a vertical section of the seat. Figure 11, a horizontal section of the ribs through the line *a b*, in fig. 10, and plan of the bottom or lower beat; *c c c c* the seat made of cast iron or other metal, upon which the valve *d d* works. The valve may be made of cast or wrought iron, gun-metal, brass, copper, or other metal, according to the size, the quality of the water, or other circumstances. The rings *e' e' e e* are faced, that is are turned true, and when shut, fit accurately to the beats *f' f'* and *f f* upon the seat *c' c c c*; *f f* is the lower beat, and *f' f'* is the upper beat. In fig. 7 *e' e'* is the top opening of the valve, and *e e* the bottom; the beats may either be formed by a raised ridge cast, or wrought upon the seat, and faced or turned true, or by introducing into circular grooves, cast in the seat, a ring of wooden wedges, or of soft metal; the top surface in either case to be faced or turned true, to receive the valve—we prefer wood or soft metal; *g g* represents a circular groove cast or wrought, on the under side of the seat, into which leather is introduced, so as to prevent leakage when the seat is bolted down in its place. *h h* is a cylinder cast upon the seat and turned true, so as to form a guide for the valve to work upon, and to keep it in its right place. *i i* is a metallic feather attached to the cylinder, and projecting into a groove formed in the valve, to prevent any circular motion in the valve; and *k k* is a cap bolted upon the cylinder to prevent the valve rising beyond a given height, or being displaced. The dotted lines *l l l*, *l l l*, fig. 4, represent the direction that the water takes when the valve is opened. *m m* represent the surface of the valve that is exposed to the pressure of the atmosphere, or force created by the motion of the piston, and which when proportioned as hereinbefore described, by making the difference in area between the space by the rings circumscribing the top and bottom openings of the valve, sufficiently great to allow the force applied to overcome the weight of the valve, will cause it to rise.

Having now described our improved valve, and in doing so, having also described certain contrivance and constructions, which we do not claim as our improvement, but the description of which was necessary to elucidate our improvement; we hereby declare that we claim as our improvement that part of the contrivance only which makes the valve self-acting, by making the area of the top opening of the valve less than the bottom and making the seat to correspond thereto, which area must be varied according to the size and weight of the valve, and must be proportioned thereto.

IRON TIES THROUGH PARTY WALLS.

Experiments tried at Chatham on the 6th of December 1839, *in respect to iron ties passing through party walls to form a continued bond for the floors of adjacent houses.*

In the course of practical architecture taught to the junior officers of the Royal Engineers of Chatham, the floors of two adjoining houses are connected by ties, each consisting of a strap of iron passing through a party wall, and bolted to the sides of two girders, in the same allinement, which sort of tie-bond may be supposed to be continued through the whole extent of a range of barracks, or of a row of houses, as was done by Messrs. Baker in their new houses on the north side of the Strand, near Exeter Hall.

The utility of this sort of continued bond could scarcely be doubted, but a query having often suggested itself, whether the destruction of the floors of one house by fire, might not heat the iron-ties passing through the party walls, on each side, so far as to endanger the floors of the two adjacent houses; Colonel Pasley directed Captain Williams to try the following experiment, which must be considered conclusive.

In the accompanying figures, *w* is a 9 inch brick wall, 6 courses high, representing a portion of a party wall between two adjoining houses. For the convenience of applying the fire, it was built upon the hearth of a smith's forge. The 4 inch wall *e*, *e*, were added merely to enclose the fuel, and to increase its heat. These walls were built the day previous to that on which the experiment was made; and as common lime mortar would have required considerable time to dry, cement

Fig. 1, Plan.

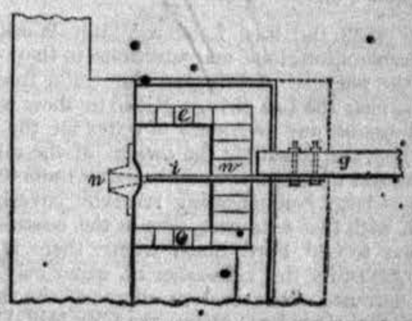
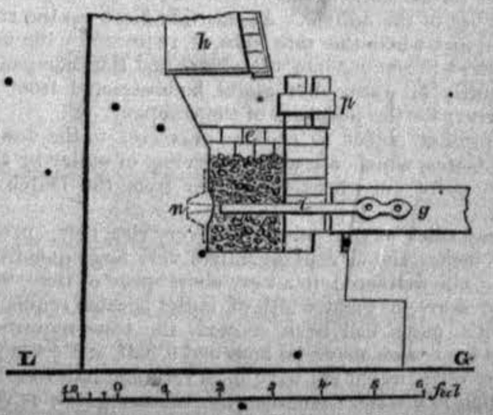


Fig. 2, Section.



p six pigs of iron ballast, each 56 lbs. to prevent the brickwork separating by the heat. *h* Hood. G, L. Ground Line.

mixed with sand was used instead of lime; *g* is a piece of Memel timber, 3 feet long, 6 inches wide, and 11 inches deep, representing part of a girder, having an interval of one inch between the end of it and the party wall; *i* is the iron strap, 3½ feet long, 2½ inches wide, and ½ inch thick, bolted to the girder *g*, and passing through, and extending beyond the wall to within one inch of the nozzle *n*, of the tew iron of the bellows. One foot four inches of its length was exposed to the fire, which was lighted at ten o'clock A.M.

By eleven o'clock the fire was in good action throughout; the coals were well heaped over and about the iron strap to within 5 or 6 inches of the top of the wall, and the heat was kept up to the greatest practicable intensity, by the uninterrupted action of the bellows, till four o'clock P.M.

It was one o'clock before that part of the iron strap in contact with the girder became too warm, even close to the wall, to render it necessary to withdraw the hand from it, and even at four o'clock, by which time 5 inches of the end nearest the tew iron were burnt completely away, there was not sufficient heat in any part of it outside the party wall, either to discolour dry wood shavings or paper, or to ignite naptha. At 6 inches from the wall the hand could be continued on the iron without inconvenience during the whole period the experiment occupied, and at no time was the party wall red hot.

There can be no doubt but that the fire might have been kept up long enough to consume the whole of the iron surrounded by it, without sufficient heat being communicated to the girder to set fire to it.

The bulb of a thermometer that happened to be at hand, was applied to the iron, where it entered the party wall, but the degree of heat could not be determined, as the tube extending only to 118 degrees of Fahrenheit, was very soon filled by the quicksilver, and was then withdrawn to prevent it from bursting.

The cement mortar in the joints of the brickwork nearest to the fire was reduced to dust. In this state, Colonel Pasley ordered some balls of it to be mixed up with water, into the consistency of a stiffish paste, which set rather slowly, but in the course of a few days became extremely hard, in consequence of the cement having been calcined by the fire, and thereby restored to the same state, in which it had been received from the manufacturer.

BALANCE GATES.

Erected at the Works of the East London Water Works Company, Old Ford. ENGINEER, THOMAS WICKSTEED, Esq., M. INST. C.E. *With two Engravings, Plates* II. & III.

IN the year 1833, the East London Water Works Company made very considerable alterations and additions to their works, by cutting a canal for the purpose of bringing the water from a higher part of the river Lea, near the Lea Bridge Mills, to their works at Old Ford, and to guard against any deficiency of water for the working the mills on the river Lea, and to satisfy the owners of the mills, the Company agreed, in the Act of Parliament authorizing them to make the alterations, to form a large compensating reservoir covering about 14 to 15 acres of land, with two entrances, one at the south-east corner of the reservoir, near to Old Ford Lock, where there is erected a pair of tide or flood-gates, for the *admission* of water only as the tide rises, and another entrance at the eastern corner of the said reservoir upon the banks of the river Lea, above the City Mill Point, consisting of three openings with six balance gates, for the *admission* of water from the river, and for *discharging* the water out of the reservoir into the river for the use of the millers. As the tide flows up the river it fills the reservoir, and when the tide ebbs, if required by the millers, the water is allowed to run out into the river, and thus compensate them for any quantity of water that might be abstracted from the upper part of the river for the purposes of the company.

It is our present object to confine ourselves to the description of the Balance Gates, which are well deserving of notice by the profession, and to point out where they differ from the Dutch system of construction.

As the neap tides at the point of delivery rise only, on some occasions, a few inches, and as consequently a very large quantity of water might have to be delivered in a very short space of time, with so low a head or pressure, a great width of outlet became requisite; if the ordinary sluice gates had been erected, the time required to open them would have been above an hour and a half, and consequently the whole of the water might not have been returned into the river before the preceding low water; whereas the balance gates, as we can bear witness to, are easily opened or closed in ten minutes, *against* a pressure of water.

The essential difference between the gates designed by Mr. Wicksteed, and the old Dutch balance gates as described in Belidor's Architecture Hydraulique, is this—the old gate is larger in area on one side of the centre than the other, on the largest side a sluice gate is introduced, which when opened reduces the area of the largest side, so that it becomes less than the other, which was before the sluice was opened, largest; by this arrangement when the sluice gate is shut the pressure of the water upon the largest area causes the gate to remain closed, but when the sluice is opened the greatest pressure is upon the other side (or *half*) of the gate, and causes it to open *but not completely*, and tackle must be made to open it *wide*. In Mr. Wicksteed's gates the sides are of equal area, and they are made to open at once by a toothed quadrant and pinion; two gates are also introduced in each opening, and set at an angle which gives strength to their construction and saves masonry. When the gates are closed, by the application of a very ingenious contrivance, consisting of a vertical iron shaft fixed in the hollow quoins, with three eccentrics or cams upon it, they are made to close against each other, and against the cills and recesses in the side walls, so that no leakage whatever takes place.

These gates are, we believe, the only ones of the kind erected in the kingdom, and when we were favoured with a view of them, they had been in use for six years and in excellent working order, they had not been repaired since they were first erected by Messrs. Hunter and English, of Bow, whose reputation as millwrights is so well known, that they needed not this accession to their fame.

The cost of the gates we could not ascertain, as they were done in conjunction with other works by contract, but we can easily give credit to Mr. Wicksteed's statement that the expence was not more, if so much, as common sluice gates with their elevating machinery, foundation, &c., when it is considered how many sluices there must have been to insure the same width of opening.

These gates are different in construction, and are used for a different purpose to those erected some years since at Lowestoff; with the exception of these two instances, we are not aware of any other gates erected upon the Dutch principle in England, but we think there are many cases in engineering where their introduction might be advantageous.

The following additional particulars we select from the contract and specification of the work, which will together with the engravings give an accurate view of their construction.

> "They (the Balance Gates) are different in construction to the common flood-gates; a description of one gate will answer for the whole: the gate is made to work upon a vertical shaft as a centre, and is equal on each side thereof. One gate, when closed, shuts against another gate on one side, while the opposite sides close against a recess in the piers or side walls. It will appear evident, upon an inspection of the plans, that the gates being equal on each side of the vertical shaft, which is the centre of motion, whatever pressure of water may be against them, that there is as great a tendency to keep the gate closed as there is to open it, and that being, under any circumstances, equally balanced, a very slight exertion of power (sufficient to overcome the friction of the working parts) will either open or close them. When the gates are closed, and it is desirable to retain the water in the reservoir, to destroy the effect that any vibration might have upon them to cause a leakage, a shaft is introduced upon which three eccentrics are cast, which, when applied to the gates, pinches them against their abutments, and thus prevents any leakage that might by possibility occur. When it is desired to open the gates to discharge the water of the reservoir into the river, the eccentric is first to be worked so as to take off its effect upon the gate, and then the quadrant and pinion must be worked to open the gate, which, as the pressure of water is equal in its action upon both sides of the centre, will be a matter requiring but a small exertion of power.
>
> *Description of the Work.*—The framing of the balance gates is to be of good English oak timber; the planking to be the best Memel plank. All the joints are to be made sound and good; the mortices to be cut out square their whole depth, and the tenons to be made so that they shall fit equally over every surface; the butting joints to be squared so as to touch and bear equally over the butting surface. Wherever the timbers are framed into the iron-work, the iron-work shall be made true and good to receive it, so that it shall bear equally on all the surfaces; and wherever wrought iron straps are let into the timbers, they shall be fitted accurately; no packing will be permitted, but the iron must fit fairly and strictly to the wood. All keys and bolts for straps, and cast iron work must be made to fit accurately, so that the bolts fill up the holes made for their reception, without shaking or depending, upon the friction of the head and nut.
>
> The timbers are to be rebated for the reception of the ends of the 2-inch fir planking, so that when the planking is introduced, the surfaces of the planking and timbers shall be flush—the planks are to be 2 inches thick and 9 inches wide, to be laid diagonally, as described in the drawings; at the two ends, and wherever there is a cross or diagonal timber, the plank shall be fastened thereunto by means of 2 screw bolts at every bearing, and wherever iron intervenes between the planking and timber, it shall be drilled, and the

EAST LONDON WATER WORKS.

Plan of the Wooden Bridge

Fig. 5

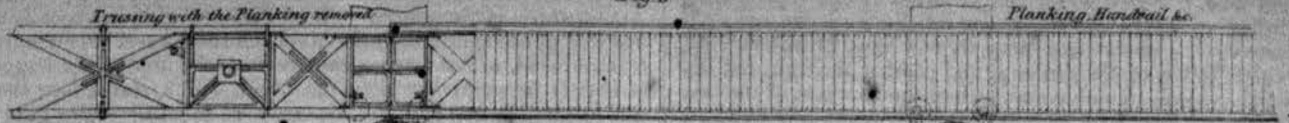
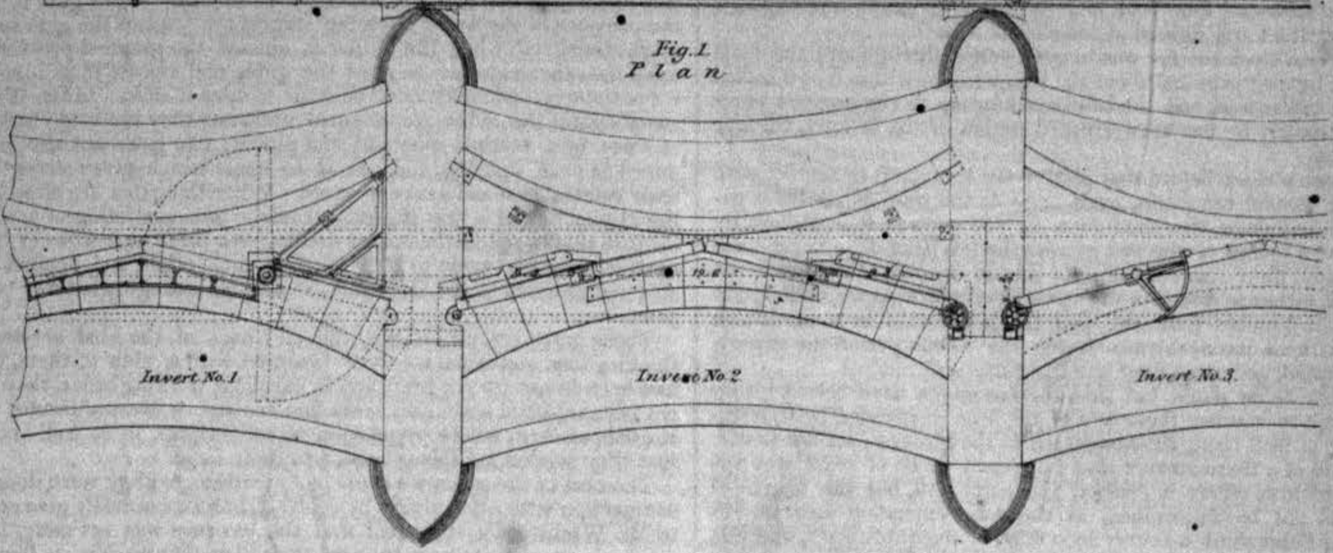


Fig. 1
Plan



Balance Gates.

Entrance to Compensation Reservoir.

Front Elevation.

Fig. 2

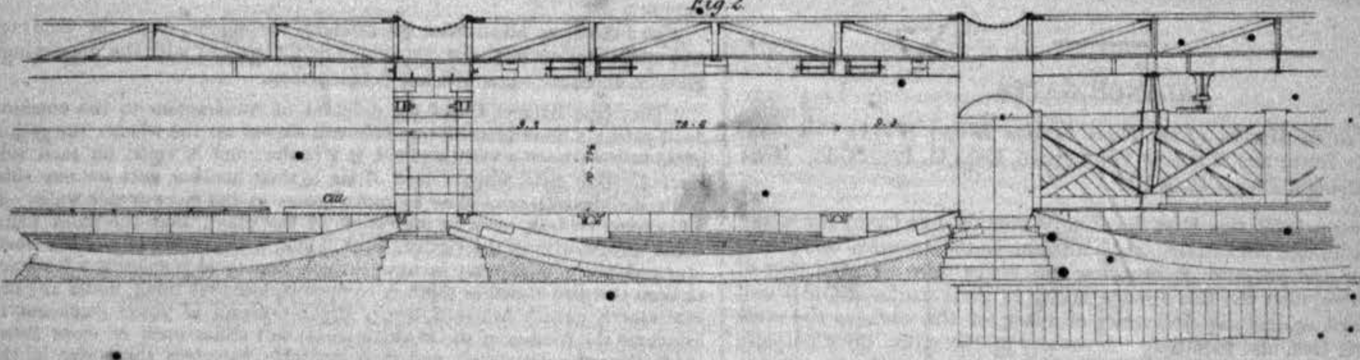


Fig. 3.
Transverse Section through C. D.

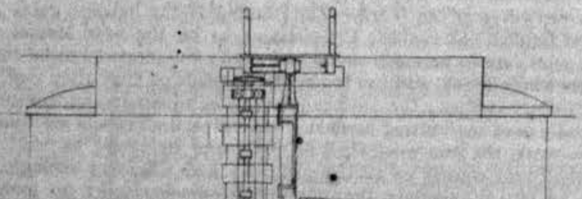
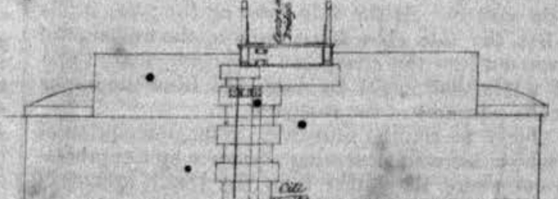
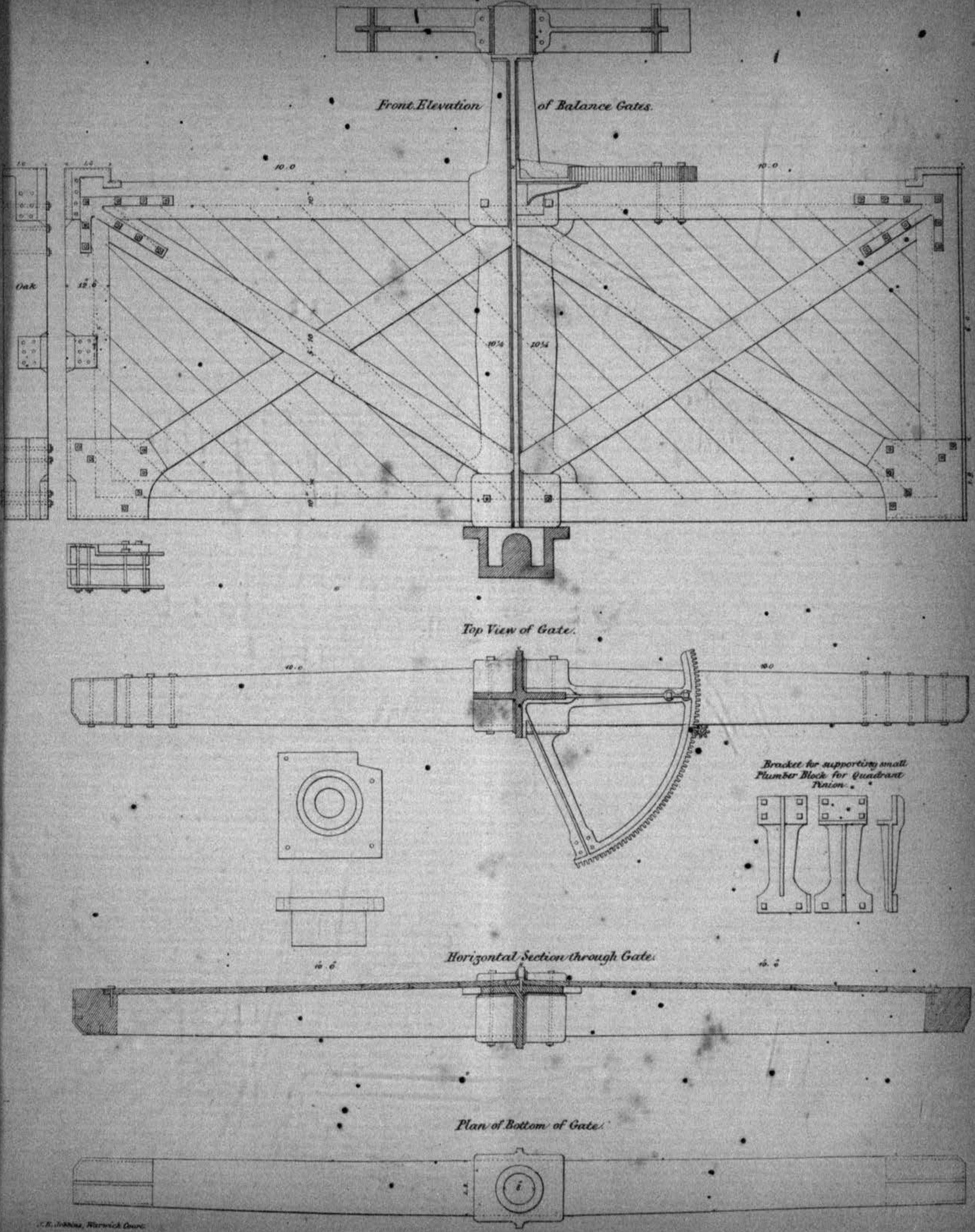


Fig. 4.
Transverse Section through A. B.



J. E. Dibbins, Warwick Court.

EAST LONDON WATER WORKS.



Front Elevation of Balance Gates.

Top View of Gate.

Bracket for supporting small Plumber Block for Quadrant Pinion.

Horizontal Section through Gate.

Plan of Bottom of Gate.

J. E. Jobbins, Warwick Court.

bolt shall fit accurately, iron to iron—the screw bolts are to be 5-8ths of an inch diameter, and 5 inches long, with square heads, and a neat iron collar under each head and nut, excepting where iron intervenes, when the bolt shall be as much longer as the thickness of the iron, so that every bolt shall have a screw of 3 inches deep in the timber. The joints of the planking shall be shot straight, fitted close, and caulked, so as to render every joint perfectly water-tight.

The pivots on which the gates revolve are to be cast hard, and fitted accurately to the hollow bearing in the vertical shaft.

The gates are to be made accurately at the meeting posts. At the sides which abut against the piers and walls, and at the cills and wherever iron intervenes, it shall be chipped and filed so as to fit flush with the timber, so that no water shall escape at the joints—the pivot and step are to be so made that the least possible leakage shall take place.

All the cast iron bearings are to be accurately turned, so as to work truly and easily, and in every case where iron works in iron, *either* the shaft *or* bearing is to be cast hard, as may be deemed advisable by the Company's engineer—the upper bearings to have set screws and keys for adjustment, as described in the drawings. All the wheel work is to be fitted accurately, and if required by the Company's engineer, the teeth are to be chipped and filed.

The same directions that are given hereinbefore for the joints in the timber and connecting straps and bolts, are to be observed in the construction of the trussed foot-bridge, which is to be wholly of the best Memel fir.

Reference to Engravings.—Plate II.

Fig. 1.—Plan of the Balance Gates, Sills, Inverts, and Piers. In "Invert No. 1," the sill pieces are shown, and the iron pivots upon which the gates are to turn. In "Invert No. 2," the gates are shown at an horizontal section through the timbers and planking, and vertical shaft; the eccentric shafts are also shown. In "Invert No. 3," the top view of the gates is exhibited with the quadrant and pinion for working the gates, and the wheel upon the top of the eccentric shaft.

Fig. 2 is an elevation of the work described in Fig. 1. The gates, however, are shewn in *projection*, or as they will appear when closed; the trussed foot-bridge for the support of the upper bearings of the shafts upon which the gates turn, is also shown in elevation and section.

Fig. 3.—A transverse section through C D (Fig. 1) of the gate and trussed foot-bridge, and an elevation of one of the piers and section of the invert, sill, and apron.

Fig. 4.—Transverse section through A B (Fig. 1).

Fig. 5 is a plan of the trussed foot-bridge, a portion of it planked as it will appear when finished, and another portion as it will appear before the planking is laid down, exhibiting the trussing and cast iron frames for the support of the upper bearing of the vertical shafts.

Plate III—contains enlarged views of the gates described in Plate II, which may be sufficiently understood by reference to the drawings.

LONDON SHOPS.

[A very able and interesting article on "London Shops and Gin Palaces," by Candidus, appeared in the December Number of *Fraser's Magazine*, from which we select the following extracts.]

We need not speak of the very superior mode in which shop-windows are now fitted up, not merely as regards the large squares of glass, and the more than atlas folio sheets of plate-glass, which have of late become almost so common as to cease to excite astonishment, but also in respect to the framework of the windows, the polished brass-work which covers the window-sill. One contrivance, however, which has been but very lately introduced, will, when it comes to be more generally adopted, greatly enhance the appearance of the shops after dark,—we mean that of throwing a very powerful light upon the goods at the window, the first experiment of which was made, we believe, on the east side of Temple Bar, viz. at the splendid new shop opened in St. Paul's Churchyard by Hitchcock and Rogers; which, in point of extent, has scarcely a rival in any other part of the town. The proprietors appear to have spared no cost to render their establishment as attractive as possible even to the very labels or tickets attached to the goods, which, instead of being merely written, are tastefully emblazoned on large card-boards, in gold, azure, and other brilliant colours. Still, when we come to consider this, and some other shop fronts of the same class, architecturally, we cannot help being offended at a defect which is here carried *à l'outrance*, to a much greater degree than any where else. In fact, the whole of this unusually extensive shop front presents to the eye nothing but glass set in very slender upright brass styles, or bars, without any apparent support whatever—without even jambs to the doors—so that the house itself, over the shop, has the look of being miraculously suspended in the air, after the fashion of Mahomet's coffin; and this not particularly agreeable appearance is strikingly increased by its returning on the west side, without any indication of prop or stay of any kind beneath the superincumbent angle of the upper part of the structure, which is actually suspended over that corner. There is no doubt that sufficient precaution has been taken to ensure security; and so far we are at liberty to admire the skill shewn by the builder in achieving what is certainly a *monsterpiece*, if not a masterpiece, in construction. His task may have been exceedingly difficult; yet we are tempted to say, with Dr. Johnson, that we wish it had been impossible. It will, perhaps, be argued, that what we here behold is, after all, not a whit more contrary to sound architectural taste than a geometrical staircase, where the steps are attached to the wall only at one end. The two cases, however, are not perfectly similar; because, in the second instance, each step is no more than either a balcony or large bracket inserted into the wall, whereas, in the other, the bressumers of the floor, above the shop, have to support all the upper part of the front, while they themselves seem to rest upon nothing except the slight frame in which the glass of the shop window is fixed. As far, therefore, as the general aspect of such front is concerned, the effect is disagreeable; while, as regards the lower part, or shop itself, taken distinct from the rest, it is exceedingly insipid and poor—very little better than what would be produced by the same space of unglazed opening for the display of goods; the chief difference being, that instead of being exposed to injury, the articles so exhibited are protected by the glass.

No doubt, every tradesman is anxious to make as attractive a display as possible of the articles he deals in; but it is, nevertheless, a great error to suppose that this is best accomplished by making the shop-window as large as the width of frontage will permit, and then to put up at it as much as it will contain. In fact, this mode—the one now almost invariably resorted to, and in many cases carried to an extent quite preposterous—rather defeats the object aimed at, because it utterly excludes all variety of design, or rather excludes design itself—reducing the whole front of each shop to only so many feet superficial of glass. Hence there is nothing to distinguish any one shop from the rest—nothing to mark it out to the eye from any distance. If strikingness of character be at all an object worth attending to, it might be far more easily and more satisfactorily accomplished by adopting a contrary system to that now in vogue, dividing what is now a single window into distinct compartments, the spaces between which would afford room for decoration, together with ample scope for invention. It is true that, as far as mere quantity goes, the display would be less than at present; but then the show of goods might frequently be rendered more striking, and might be every day made a fresh one, by some of the articles being changed. The great desideratum, it may be presumed, is to render the shop itself a conspicuous object—one that cannot fail to arrest the attention of every one who passes; and this, we conceive, would, in most cases, be better accomplished by making it a catching architectural "frontispiece"—no matter how much the space now allotted to a window might be trenched upon for such purpose.

* *

Even at present we have one or two things, which, although they do not exactly exemplify the mode of design we could wish to see adopted, may be quoted as instances of very superior taste, and withal, of more originality and study than are to be discovered in buildings of far greater importance. Among these, we do not hesitate to say that the *facile princeps* for *recherché* elegance of design, for purity of taste, for happiness of invention, in the whole composition, together with admirable beauty of finish, is a small shop front, or, rather, a small façade, in Tavistock Place. It is an exquisite architectural gem—at least every professional man and real connoisseur must at once recognize it as such—although its beauties and merits are of that kind which are not likely to ensure it particular attention from persons in general; because in such matters the million are apt to form their estimate according either to size or to gaudy showiness. No man who understands architecture can look at it without feeling that the worthy George Maddox here worked up his ideas *con amore*, with the relish of one enthusiastically devoted to his art for his art's sake. The whole of this front—for we ought to observe that the design is not confined to the lower part or shop alone—is in perfect keeping: we do not find merely a very good bit in this place, a very nice piece of ornament in another; something happy there, and something not amiss here, but the *ensemble* is complete; the same taste pervades every part: nothing can either be added or taken away without detriment to the whole. What simplicity in the general character of this little façade! yet so very far is it from partaking of any thing like poverty, that it is particularly remarkable for the unusual care bestowed upon all its details. Indeed, there are only one or two buildings in the whole metropolis that can stand the test of comparison with it in that respect. Examine the capitals and entablature of the order that forms the shop front itself, and you must allow them to be no less beautiful than novel, that is, supposing you are competent to appreciate the originality and taste there manifested. After all, it must be allowed to have one unpardonable fault: how great soever may be its merits in point of design, it wants magnitude—at least to give it sufficient consequence and importance in the eyes of ordinary beholders. Truly it does; and so, also, does that beautiful little architectural gem of antiquity, the monument of Lysicrates, which, in regard to size, is little better than a mere model, or toy. To be sure, the one example is at London, the other at Athens; and that, it must be acknowledged, does make a vast difference in the opinion of the vulgar, both learned and unlearned. Most certainly, there is no denying that Tavistock Place is not Athens, any more than that Saffron Hill is not Mount Hymettus.

The only thing that can fairly enter the lists with the façade we have been speaking of, is the one No. 22, Old Bond Street, which is likewise singularly beautiful, and treated throughout with true artistical feeling. It is the production of the Messrs. Inwood, or of one of the brothers, and it certainly displays more invention and taste than all their other designs put together, if we except the columns and doors in the portico of St. Pancras Church; the former of which, however, are merely copies from those of the triple temple on the Athenian Acropolis. These two are almost the only instances in which the whole of such a front is consistently designed and decorated throughout, so as to be altogether of a piece from bottom to top; for the shop and the house above it are, we may say, invariably treated as distinct from each other, instead of being combined, as far as their inevitable difference of character will permit, into one uniform composition. This is more or less the case, even where architectural embellishment is liberally bestowed on the upper part of the front, the superstructure having so little architectural connexion with the basement on which it stands, that the effect is quite incongruous. Of this we have notable proof in a shop in St. Paul's Churchyard, already spoken of; since, so far from there being an apparent connexion between one part and another, we might fancy that the upper portion, with its Corinthian pilasters, had been taken off from a rusticated basement, and suspended upon the huge glass case beneath it, which it threatens to crush. A greater architectural antithesis than the one thus produced can hardly be imagined, the whole of the lower portion presenting the very minimum of strength, an appearance of unusual weakness and fragility, while the upper has a more than usual character of solidity, owing, among other circumstances, to the breadth of the piers between the windows; that is, however, of solidity when it is considered apart from its baseless position, because that exceedingly false position gives it the appearance of being particularly insecure, and in imminent peril of performing an *aplomb*.

Perhaps, of the two inconsistencies, it is the lesser one where, as is almost the general rule, architectural expression is confined to the shop-front itself; all the rest being left quite unpretending and plain, even to nakedness. It must be admitted, that the other method is greatly preferable, as far as the general appearance of a street is concerned, inasmuch as it conduces to its architectural dignity; yet, as regards the houses individually, it is better that the shop-front itself should be made exclusively the feature on which architectural design is bestowed, unless, indeed, it can be consistently carried on upwards.

Although frequently no other economy than that of space seems to be regarded, it cannot be affirmed that much either of invention or taste is displayed in our London shop-fronts, of which carpenters seem, for the most part, to be the designers; yet here and there one may meet with a clever bit,—good both in regard to ornament and composition. These, however, form merely the exceptions; for the taste usually displayed is most flimsy and frippery, and full of inconsistencies. At the best, things of this kind can be little more than mere bits; because, owing to their want of size, they can hardly produce any effect in a general view, or until approached and examined; yet that is no reason wherefore they should be undeserving of examination, and bits of tawdry trumpery in themselves. On the contrary, if they do not afford much latitude for the display of design and invention in any other respect—an opinion, however, to which we ourselves are strongly opposed—they most incontestably offer ample scope for experimentalising in the way of columns and entablatures. Nevertheless, so far from any advantage being taken of this, we scarcely ever find any novelty whatever of decoration attempted in regard to such features, which are no other than copies from Stuart's plates. However anti-classical, gimcrack, Cockney, every other part of such design may be, we behold Grecian Doric and Grecian Ionic copied with most superstitious exactness, and repeated *usque ad nauseam*. The Athenian Doric of the Parthenon, and the Pæstan example of the same order, are most ridiculously *minified*, and applied when they are most offensively out of place, putting us out of conceit both with them and with what but for them would have been honest, unsophisticated, Cockney carpenters' work. Away with the worse than schoolboy—the dull schoolmaster vapouring, about the intrinsic beauty of form and proportions belonging to the ancient orders, as if they possessed an indefeasible charm adhering to them under any circumstances. At that rate, it would be excellent taste to convert the legs of a table into four pigmy columns, Doric or Ionic; or if the mere models of such things possess in themselves a magic charm for the eye, neither could they fail to please were they dragged in any where else for the nonce, even should it be into a Gothic building. The truth is, no such kind of beauty exists either in them or any thing else: a fine arm and hand are very beautiful in a fine woman, or, for the matter of that, even in a plain one; yet how they could be made to add to the beauty of a horse, we certainly do not see. Of all the styles, the one least suitable for purposes which require it to abandon more or less of its original character, is the Grecian Doric, whose sternness and severity, apart from the imposing grandeur attending magnitude of dimensions, are apt to degenerate into frigidity and hardness when the order is exhibited upon a trivial scale. Instead of attempting to counteract this defect, which predominates in most modern imitations of that style, we increase it by omitting all sculpture and other decoration, as not included in the idea of the architecture itself, although it is essentially indispensable to its effect. By the chilling bareness thus occasioned, a style naturally stern in itself becomes aggravated into disagreeable harshness; more particularly when reduced to more than ordinary insignificance of size; for all dignity of expression is lost, and in lieu of it we obtain poverty of style, with an affected heaviness of form,—something nearly as grotesque as a little Cupid proportioned after the brawny form of the Farnese Hercules.

Yet such is the style upon which, at least, one-half of our modern shop-fronts are modelled. As far as the columns alone go, they are tolerably accurate, and intolerably dull fac-similes of the different examples measured by Stuart and others; but there all resemblance ends. The frieze—should there happen to be any such member in the entablature—is as plain as the architrave; nevertheless, such disregard of authorities is a trivial fault, in comparison with the wholesale disregard of the genius of the style itself. Yet so it is: over-exactness as to certain particulars goes hand in hand with the most fantastical licentiousness—if that can be called fantastical which manifests not the slightest aim at fancy. It is, however, not so much the deviation from precedent that we censure in such cases, as the awkward and absurd adherence to it, or rather the affectation of adhering to what it is impossible to follow consistently as a model. Even supposing that, in regard to the architecture itself, the style could be sufficiently well kept up, still it would very ill assort with the display which it is intended to accompany. Fancy goods and Pæstan columns—plumes, velvets, artificial flowers, and Doric pillars—do not harmonise well together, nor seem to be suitable company for each other. A striking instance of such disparity between the richness of the stock it contains and the shop itself is Holmes's shawl warehouse, in Regent Street; where, notwithstanding the splendour of the *coup d'œil* of its interior, the exceedingly massive, not to say rude, Doric columns supporting the ceiling look most uncouthly lumpish amidst all the costly finery around them. Surely, a lighter style would have been far more in character; or, if pillars of that bulk were absolutely required, they might easily have been enriched. It is true, they might then have lost all resemblance to Doric columns; yet of what consequence would that have been, or rather it would have been so much the better, supposing them to be appropriate and pleasing in themselves—that is, successful inventions; and if we dare not venture upon any experiments in architectural design on such occasions, we are not likely ever to make them, when the question is to erect a building of magnitude, where every thing is expected to be perfectly *secundem artem*, and where, of course, nothing can be admitted that might possibly be sneered at as a rash innovation—a startling new idea.

Perhaps it would be some step towards improvement, were such style of design adopted for the decoration of shops as would in a certain degree accord with the stock itself and the particular business carried on. Attention to congruity of this sort would, doubtless, have suggested for the one just referred to above, a style altogether different from what we actually behold—something light, fanciful, luxuriant; and, if not professedly in the Oriental taste, that is, after an express pattern of it, yet more or less approaching to it. Characteristic peculiarity of this kind, however, would of necessity be chiefly limited to those cases—at present exceedingly rare ones—where the interior of the shop itself is fitted up, like some of the Parisian ones, with regard to effect as an architectural *ensemble*, so as to have more the air of an apartment furnished with certain articles there displayed, than of a mere warehouse where they are stowed away on shelves that entirely line the walls. The same diversity could not very well be extended to the exteriors, or shop-fronts themselves; because that would be apt to occasion a very disagreeable medley of all sorts of styles in our streets, and give them a most motley appearance. To be convinced of this, we need but look at Saunders and Woolley's shop-front in Regent Street. Whatever may be thought of the particular taste of embellishment—the so-called *Louis Quatorze*—there displayed, it is sufficiently significant; and we have no doubt that, as a design upon paper, shewn quite by itself, without any accompaniment, it made a striking and alluring appearance; yet, as actually beheld, it is as much of a blemish as a beauty,—no improvement to the street, except as affording a very showy display of window and costly articles of upholstery; and decidedly injurious to the façade where it has been introduced. The style itself is, moreover, by far too exotic and anomalous to be at all adapted for exterior architecture, even were an entire front to be designed in it so as to form a consistent composition. The Gothic style, however, that is, some varieties of it, might occasionlly be resorted to both with propriety and effect; although we are not aware of its having been hitherto applied to such purpose, except at Fairs's, in Mortimer Street, an exceedingly small, at least very narrow, upright, strip of Elizabethan architecture, clever, and not a little picturesque. That the pale bronze hue given to that pretty architectural façade is attended with other advantage than that of rendering it more conspicuous, is what we will not undertake to decide; since greater variety, and quite as much propriety in regard to colouring, might have been obtained, imitating the weather-stained tints of stone and brick, with, perhaps, some of the mere ornamental parts in imitation of bronze, or other metal.

Our catalogue of *shops*, would be longer than Homer's catalogue of *ships*; and, we venture to say on our part, not very much more interesting, were we to note all that aim at being remarkable as well as fascinating. There is hardly a street of them at the west end of the town, in which one or more will not be found affording evidence of a desire to attract observation by something more than the show of goods behind the glass; but we cannot say that many of the designers have displayed much fancy or taste, or greatly taxed their invention for the benefit of their employers. In almost all of them we perceive some little, and but very little, aim at originality—a mere beginning towards it—in scarcely one instance a complete developement of a novel idea; consequently, there invariably seems to be more pretension than actual performance. Colnaghi and Puckle's new shop-front, in Cockspur Street, presents some novelty of style and detail, and is remarkable for the great projection of the cornice, which is brought forward as much as the half-octagon bay in the upper part of the house. The style itself partakes of both the *Renaissance* and the Elizabethan; and, independently of the panels with which they are embellished, the extreme piers assist the design very much, both by giving an air of stability to the *ensemble*, and a suitable termination to it. Cowie's, in Holles Street, is singular, chiefly on account of the window shewing itself somewhat like a glass-case inserted in the front, and being dark brown relieved with gilding; while the door, which is detached from it, has enormous white consoles, enriched with gilt mouldings, though all the rest are of very dark hues; a contrast of colours more *tranchant* and striking than tasteful. In the adjoining street, viz. Henrietta—Marshall and Stinton's makes a quiet sort of display with its four three-quarter Ionic columns, between which are three arches, of which the two forming the windows are each filled in with a single sheet of plate-glass; which species of luxury is not rendered less singular by the extreme plainness of the windows themselves. We should recommend some liberal decoration in the spaces between them and the columns.

The new front of No. 76 in the Strand, now the "Foreign Marble Warehouse," may be cited as almost the very reverse of the preceding, being as studiously embellished as the other is studiedly kept plain. What little design there is in the shop itself, has neither much novelty nor much taste; it is the elevation above, and in a manner distinct from it, which presents a sample of an unusual mode of embellishment, it being liberally, yet not too liberally, decorated with medallions and figures in relief between the windows; and but for the disagreeable heaviness of the odd-looking cornices to the windows of the first floor, would be an agreeable composition, though susceptible of improvement in other respects besides the defect just pointed out. Had the exterior of the adjoining house been added to the design, so as to give greater width to the elevation, the effect would have been increased in more than arithmetical progression.

ON THE SUPPLY OF WATER TO THE METROPOLIS.

Observations on the past and present supply of Water to the Metropolis. By Thomas Wicksteed, *Civil Engineer. Read before the Society of Arts, May* 24, 1835.

(Continued from page 12.*)*

During the next two centuries, namely, from A.D. 1600 to A.D. 1800, were established several water-works of minor importance, as follow:

To the Merchant Water-works belonged three engines for raising water; one a windmill in Tottenham Court Road Fields; and two overshot water-wheels, worked by the water of a common sewer in St. Martin's and Hartshorn Lanes in the Strand; there were three mains of 6 and 7 inch bores to supply the respective neighbourhoods.

The Shadwell Water-works, erected about 1660, had first a horse-wheel, and afterwards two atmospheric engines, which supplied the neighbourhood with Thames water through two mains of 6 or 7 inch bores.

In 1691 these works, which had previously belonged to the family of Thomas Neale, Esq., were vested in a company of proprietors, who were incorporated by an act of Parliament 3rd and 4th of William and Mary. Two engines, of Boulton and Watt's manufacture, were afterwards erected; the first was one of the earliest engines made by them. When the London Docks were made, the district was much reduced in consequence, and the works were purchased by the Dock Company; and afterwards an act was obtained in 1808 by the East London Water-works Company to enable them to purchase these works, which they did. The works were in play for a short time afterwards, but were eventually given up, the supply from the Company's new works being superior.

The York Buildings Water-works, in Villiers Street, Strand, were established in 1691. The Thames water was raised for the supply of the neighbourhood, first by a horse-wheel; afterwards previous to the year 1710, they had one of Savery's engines; and a few years afterwards one of Newcomen's. Maitland says in his work, published 1756, that "the directors of this Company, by purchasing estates in England and Scotland, erecting new water-works and other pernicious projects, have almost ruined the company. However, their chargeable engine for raising water by fire being laid aside, they continue to work that of horses, which may in time restore the Company's affairs." This was true for a time, as it appears that from 1789 to 1804 this Company paid good dividends, but afterwards, in consequence of the ruinous competition that arose at that time, and for some years subsequently, a new engine was erected of 70 horses power, iron pipes laid down instead of wood, and no more dividends were paid, excepting 1*l*. per share for two years, out of the *capital*; and in 1818 the Company was ruined, the establishment broken up, and the district was supplied by the New River.

In 1775 Mr. Watt mentions an engine of Newcomen's at the York Buildings, and Mr. Farey calculated its power at about 26 horses, working 7 hours per diem, and raising during that time about 356,000 gallons to a height of 102 feet, or 3,137,000 barrels per annum. In 1810 the quantity raised at these works was only equal to 178,200 gallons per diem, or 1,544,400 barrels per annum. In 1818, before the breaking up of the establishment, the quantity raised was 762,588 gallons per diem, or 6,609,252 barrels per annum; which supplied about 2636 tenants.

The Chelsea Water-works were established in 1722 by an act of Parliament, in the 8th of George I., for the better supplying the city and liberties of Westminster, and parts adjacent, with water.

The Thames water was raised from settling-ponds, in the first instance, by a water-wheel, which was worked by the water collected in large ponds as the tide rose, and kept in until the water in the river lowered, when it was let out and worked the wheel: afterwards two of Newcomen's engines were erected, and in 1782 one of Boulton and Watt's engines,—one of the earliest erected in London.

The West Ham Water-works were set on foot in 1743, and a company was established by act of Parliament the 21st of George II., in 1747. The water was raised out of one of the branches of the River Lee by a fire-engine of about 6 horses power; these works were afterwards purchased by the East London Water-works Company, at the same time that they purchased the Shadwell works; and the power now used is a water-wheel of about 16 horses power.

Previous to the year 1756 there was a horse-machine for raising Thames water through a 7-inch pipe in Southwark, called the Bank End Water-works. A company was formed in 1758, under the name of the Old Borough Water-works Company, which, together with the London Bridge works, supplied Southwark. A steam-engine was erected afterwards; and in 1823, upon the removal of the London

Bridge water-wheels, the two works were consolidated, under the name of the Southwark Water-works, and became the property of John Edwards, Esq.

Previous to 1756 works were established at Rotherhithe. The water was raised by a water-wheel, which was worked by tide water, collected in the ditches and ponds in the neighbourhood, and kept in until the falling of the tide, when it was let out again into the river, and in its course turned the water-wheel; it supplied the neighbourhood plentifully through two 6-inch mains.

Previous to the year 1767 works were established at Lee Bridge, upon the river Lee, worked by a water-wheel, for the supply of Hackney and Clapton; they were called the Hackney Water-works, and in 1829, after which period they became the property of the East London Water-works Company, they raised about 600,000 barrels per annum for the supply of about 600 families.

In 1785 the Lambeth Water-works were established by act of Parliament 25th of George III., to supply the district upon the south side of the Thames, exclusive of the parishes of St. George's and St. Saviour's Southwark. The water was raised from the Thames near Waterloo Bridge by steam-engines.

From the year 1800 to the present date, the following works have been established:

In 1805 the South London Water-works were established by act of Parliament 45th of George III., to supply the district on the south side of the Thames not already supplied by the Lambeth and Southwark Water-works. The works are at Vauxhall.

In 1806 the West Middlesex Water-works were established by act of Parliament 46th of George III. The works are at Hammersmith, and they supply Hammersmith, Kensington, Paddington, and Marylebone.

In 1807 the East London Water-works were established by act of Parliament 47th of George III.; they have works at Old Ford, which is their chief station for the supply of the eastern parts of the metropolis. They have purchased the Shadwell, West Ham, and Hackney Water-works, and have works and machinery for raising water at Stratford and Lee Bridge. Objections having been made in 1828 to the source from whence they raised their water, it being asserted that as the tide affected the river Lee in that part, the water "partook of the nature of Thames water," the Company, to remove all doubts, obtained parliamentary powers in 1829 to change the source of supply, and, according to the powers granted, they have, at an expense of nearly 80,000*l*., constructed reservoirs and a canal for the purpose of bringing water from a part of the river Lee which is far above the influence of the tide; so that now the water raised at Old Ford is *Lee Water only*. I mention this more particularly because it has been erroneously asserted that *Thames water* is supplied by this Company.

In 1810 the Grand Junction Water-works Company was established by act of Parliament the 51st of George III. This Company first supplied water from the Grand Junction Canal; this supply was not only limited, but was also objected to by some of the tenantry, who preferred Thames water: the works were accordingly removed to the banks of the Thames at Chelsea. This Company together with the West Middlesex and Chelsea Water-works Companies supply the western parts of the metropolis.

It appears that, in the *first* instance, when it was necessary to bring water from a distance, the Corporation were the chief promoters of all schemes for better supplying London; and never more so, than when they granted a lease of the London Bridge arches to Peter Maurice at a nominal rent; but it is probable that this supply never exceeded six millions of imperial barrels per annum—not 2 per cent. of the present supply.

Afterwards Sir Hugh Myddleton executed the plan for bringing the greatest supply to London; he was, however, ruined, the undertaking being too extensive for an individual.

And at last several wealthy men joined together, and subscribed money sufficient to execute large plans for efficiently supplying every portion of the metropolis, which is now most abundantly supplied with good water at the rate of ¾ths of a farthing for an imperial barrel, or 36 gallons, which is the amount received by the Water Companies for every barrel they distribute, according to the parliamentary returns. This abundant supply is continued through the night, to be used in case of fires happening.

In some of the suburbs of London water is still supplied by carriers. Where it is carried in buckets from wells, it is sold at the rate of 8*d*. per barrel, or 42 times as much as when supplied by machinery; and when it is carted from the river, at 4*d*. per barrel, or 21 times more than machinery. As it is more than probable that it could not be sold at a cheaper rate in ancient times, the advantages obtained by the introduction of machinery will appear very great.

In addition to the works before mentioned, there are the Kent and the Hampstead Water-works. The Kent Water-works are situated upon the River Ravensbourne at Deptford. The machinery consists of a water-wheel and two steam-engines. The water from this river is supplied chiefly to Deptford, Greenwich, Woolwich and Rotherhithe: these works are scarcely considered metropolitan.

The Hampstead Works are small; they are the same that have been mentioned before, and are the most ancient of any of the existing works. In 1803 the New River Company supplied the tenantry.

Present Supply of Water to the Metropolis.

According to the report of the Select Committee of the House of Commons in 1834, the quantity of water raised by the eight metropolitan water-works in the year 1833 was equal to 357,288,807 imperial barrels; the number of houses supplied was 191,066, and the average daily supply was above 35 millions of gallons, or 183 gallons per house upon the average.

The following detailed account is taken from the Parliamentary Reports:

The New River Water-works supplied in 1833, 171,975,000 imperial barrels of water, 21 millions of which were raised by machinery 60 feet above the level of the New River Head, the remainder supplied by the river, which is 84 feet above the level of the Thames, a sufficient elevation to supply ⅞ths of the New River district without the aid of steam or other power. The number of houses supplied was 70,145; the capital expended from the commencement of the works has been 1,116,964*l*.; the rental received from the houses supplied with water amounted to 98,307*l*., and from lands and houses 6601*l*., or a total income of 104,909*l*.; the expenditure was 61,163*l*., leaving 43,746*l*. to be divided, or not quite 4 per cent. upon the capital. These works supply the greatest number of houses.

The East London Water-works rank next to the New River Water-works; the quantity of water supplied by them in 1833 was equal to 56,715,890 imperial barrels, all raised by machinery, under an average pressure of about 110 feet: the number of houses supplied was 46,421; the capital expended from the commencement of the works has been 594,988*l*.; the gross rental was 53,061*l*.; 22,166*l*. was divided, not 3¾ per cent. upon the capital.

The Lambeth Water-works supplied 17,997,903 imperial barrels in 1833, all raised by machinery; the number of houses supplied was 16,682; the capital expended from the commencement of the works has been 182,553*l*.; the gross rental was 14,808*l*.; and 3,840*l*. was divided, not 2½ per cent. upon the capital.

The West Middlesex Water-works supplied in 1833, 30,000,000 imperial barrels, all raised by machinery; the number of houses supplied was 16,000; the capital expended from the commencement of the works has been 404,263*l*.; the gross rental was 45,500*l*.; their shares are valued at 68*l*. 8*s*. 9*d*., and 3*l*. per share was divided, less than 4½ per cent. upon the shares, but more than 6 per cent. upon the capital expended.

The Chelsea Water-works supplied in 1833, 23,629,500 imperial barrels, all raised by machinery; the number of houses supplied was 13,892; the capital expended from the commencement of the works has been 271,311*l*.; the gross rental was 22,906*l*.; 4,800*l*. was divided, or 1¾ per cent. upon the capital.

The South London Water-works supplied about 12,166,666 imperial barrels in 1833; the number of houses supplied was 12,046; the capital expended from the commencement of the works has been 245,306*l*.; the average per share was about 245*l*., and they were last sold at 85*l*. per share; the gross rental was 8,839*l*.

The Grand Junction Water-works supplied 32,553,850 imperial barrels in 1833; the number of houses supplied was 8,780; the capital expended from the commencement of the works has been 331,174*l*.; the gross rental was 26,154*l*.; dividend rather more than 4 per cent.

The Southwark Water-works supplied 12,250,000 barrels in 1833; the number of houses supplied was 7,100; the capital expended since 1823, when the Old Borough and London Bridge works were consolidated, has been 25,000*l*.; the works belong to private individuals, who state that the Borough Water-works did not pay 1 per cent, and the London Bridge never more than 3 per cent.

The whole capital expended since the establishment of these water-works has been 3,171,559*l*.; and the amount of dividend upon this capital in 1833 was between 3 and 4 per cent. All of these were for many years without any dividend, and frequently much lower than that before named,—seldom higher.

I think the foregoing statement will prove that the profits of the public Water Companies have not generally been very exorbitant; and that, whatever objections may be made in particular cases, great credit is due to the enterprise of those who have, for a trifling gain, risked their property for the public good.

I cannot proceed further without remarking, that in the observations

I have made, and am about to make, I am not advocating any particular interests, but merely expressing my individual opinion of a great public good; nor do I think the circumstance of my being at present connected professionally with one of the largest of the Water-works Companies should be any bar to the expression of an independent opinion. In the following observations, I can only regret that others more competent have not taken the task in hand, knowing, as I do, how many there are connected with this Society infinitely better able, from age and experience, to do justice to the subject.

That Great Britain stands pre-eminent amongst nations is not only on account of the valuable minerals in which she abounds, and which is accidental, but also on account of the industry and perseverance of her subjects enabling them to overcome the greatest difficulties, and to avail themselves to the fullest extent of the resources Nature has blessed the islands with.

The chief reason that there are larger and nobler establishments for the public good is, that in England, instead of the Government executing and controlling the large public works, enterprising individuals join together, and, each subscribing a portion of his property, execute the largest and grandest works. The only inducement is the fair expectation that the money subscribed will yield an equitable return for the risk incurred. This return is made by that portion of the community who derive advantages from the undertaking,—advantages which could not be obtained excepting by joint subscription. If any work is undertaken which, although beneficial to some portions of the community, is not to others, that only which derives the benefit pays for it; whereas, if it were undertaken by Government, in many instances the *whole* would have to pay for the *part* enjoying the benefit, or no works upon a similar plan to those which, until of late years, were peculiar to Great Britain, would be undertaken, as the acquiescence of the majority must be obtained before a wise Government would embark in any large undertaking.

This system, as every other, may be abused; but I am speaking of the system when it is properly worked, not otherwise.

The case of Sir Hugh Myddleton is one showing directly the necessity of many individuals joining together; the undertaking was too large, and the risk too great for one man, to ensure a safe return; he therefore was ruined. If in the first instance others had joined with him, a portion only of his fortune would have been lost. It is not to be expected that Companies can be formed without a fair chance of a return for the money risked: and as the benefit derived from great public works cannot be obtained otherwise, the nation, while it is doing right to guard against abuse, must, on the other hand, be cautious that, by requiring too much, it does not render the article too costly, and thus put a stop to the system. Every Company, as every individual, expects and ought to be remunerated, otherwise there is an end to companies.

There have been many abuses of the system, and a consequent suspicion of it; individuals not unfrequently most honestly undertake to expose these abuses,—it is a difficult task; care must be taken that in attempting to cure a limb the whole body is not, through ignorance, destroyed.

In determining upon the supply of water to a large district, the chief points to be attended to are, first, whether it is to be obtained at such a cost that those who risk their money to obtain it can supply it at an unobjectionable price, and at the same time be fairly remunerated; second, that the quality be good; and third, that the quantity be abundant.

On the first I have to observe, that in London, with the exception of the greatest portion of the New River supply, the water has to be raised by the power of steam to dwelling-houses situated *above* the source; and by the same power it must be forced through pipes, so that each inhabitant shall have a supply: to preserve and continue this power is the greatest source of expenditure in water-works. *If* water cannot be obtained in the *neighbourhood* at a sufficient elevation to run into the houses of the inhabitants, recourse must be had to mechanical power, or the plan of carrying water from a distance by human labour must be readopted. The power necessary is in proportion to the quantity of water required and the height to which it has to be raised. If the elevation is 100 feet, it will require double the power that it would if it were only 50 feet; if, therefore, the rivers near London are discarded, and deep springs are resorted to, the height to which the water will have to be raised will be at least 100 feet greater than the height from the rivers, and the expense will be proportionately increased, which must be met by increased payment for the water. To raise the present supply of London 100 feet high, without considering friction, a power equal to about 1480 horses will be required, working 12 hours per diem.

In addition to this, as the water supplied by the New River Company is now delivered by their river at 84 feet above the water of the Thames, taking the average pressure at 60 feet, an additional power of 430 horses, working 12 hours per diem, would be required, or a total increase of power equal to more than 1900 horses. To establish and maintain this power would require an investment of capital equal to about 1,500,000*l*. The same reasoning will apply to *filtering* the *whole* supply.

This fact must be borne in mind, that if more capital is laid out in what is, often erroneously, termed *improving* the supply, higher rates must be paid; and if those who pay for the water are not satisfied, and are willing to pay higher rates, they can have a more costly article; and that if any alteration is made in the general supply of water, which leads to increased expenditure, whether this is made by the Companies already established, or by new Companies, the case is the same,—higher rates must *eventually* be paid, whatever is done in the *first* instance; and this appears to me a statement which no unprejudiced individual can gainsay;—I am speaking of the *general* supply, not of any particular cases.

And this brings me to the second point, namely, quality. From the parliamentary inquiries lately made, it appears that owing to the improved drainage in London consequent upon the abundant supply of water which has of late years flowed into the sewers, the water of the river Thames had in that portion in which the drainage took place become inferior in quality to what it had been before. The strongest evidence upon this subject was that of Dr. Bostock, a gentleman of well known experience in the analysation of waters; he stated distinctly that the impurities of the water were mechanical, and might be separated by filtration. It would also be well to notice what proportion of the supply of London comes from this objectionable source: about 65 per cent. of the whole supply is *not* Thames water; about 22 per cent. is either taken above Hammersmith Bridge, beyond the influence of the London drainage, or is filtered; and as to the remaining 13 per cent., powers are, or are about to be obtained forthwith to change the source of supply. In the latter case delay has been occasioned by a belief, justly founded, that Parliament would have proposed a plan for their supply; and in fact, powers were refused the parties until it was determined whether this would be the case or not.

For drinking, spring water is the pleasantest; and although it may contain certain salts, which render it hard and unfit for domestic purposes, it is not in the slightest degree injurious to health. Few would prefer river water to drink, if they could obtain spring water, as the very quality of softness which renders river water so valuable for general purposes, is that which renders it flat and unpalatable, namely, the absence of salts, which causes the water to be hard.

Thirdly, as to quantity; that this is a point of very great importance may easily be proved. In 1833, 191,066 houses were supplied with water; the quantity of water raised was 35 millions of gallons daily. Supposing each house required 9 gallons per diem for drinking in the simple form, or otherwise, this would amount to $\frac{1}{20}$th of the whole quantity, or 5 per cent.; and the remaining $\frac{19}{20}$ths, or 95 per cent., is required for washing, cleaning sewers, watering gardens, and running down the channels in the public streets, and a portion for manufacturing purposes, and for fires.

The Water Companies are bound to give an abundant supply in case of fire; and during the time that the cholera morbus raged, a gratuitous supply was given, and the water was allowed to run out of the mains down the streets, alleys, and courts whenever required;—in the first instance insuring the lives and property of the public against fire; and in the second, preventing the spread of disease by rendering the whole, but especially the thickly populated parts, of the Metropolis healthy.

If, therefore, so small a quantity is required for drinking, and so large a quantity for other purposes, it would be a very imperfect scheme which sacrificed the latter for the former.

If a purer water *can* be obtained, and *is required*, either from deep springs or by universal filtration, as this cannot be done excepting by an enormous outlay of capital, and a proportionate increase of rates, which is preferable,—that the whole 35 millions used for all purposes should be filtered; or that for a short season every year, when the rivers are discoloured, each inhabitant should have a portable filter, which may be obtained for 20*s*., and filter the twentieth part? That the latter would be the cheapest to the consumer I am quite satisfied. I am of course speaking now of that portion of the supply out of the influence of the London drainage, and which is only mechanically affected in rainy seasons, at all other times being clear and free from mechanical impurity. I say mechanical impurity, in contradistinction to chemical impurity: the first may be got rid of by deposition or filtration; the second cannot be got rid of but by changing the source. The evidence, however, given before Parliament shows that none of the water supplied to London is so *chemically* impure, as to be in the least degree injurious to health.

That all inquiries into abuses are good and desirable there is no denying, but it appears to me that exaggerated statements have been made of the abuses in Water Companies, and that it is not generally borne in mind that if any increased outlay is necessary it may be effected at much less cost, eventually, to the tenantry, by those whose works are established and whose experience is great, than by others; and the fact that great works have lately been executed by some Companies, and that more are about to be undertaken by others, without increasing the rates, shows a disposition on the part of those engaged in them to make the good of the public their first object. That some are obliged to increase their rates, upon a greatly increased expenditure, arises from the difficulties being so great that the Company could not be carried on without it, and unless other parties will undertake, and *be bound under sufficient securities*, (to be determined by Parliament,) to supply such districts at lower rates, an increase should not be objected to.

I am fearful I have too long occupied the time of the Society in observations which, as they are those of an individual only, cannot be of much importance; but thanking them for their kind intention, I will conclude by an explanation of the mode in which a town is supplied with water according to the present system.

If any town be so fortunately situated that a supply of water may be had from springs in the *neighbourhood*, of good quality, abundant in quantity, and at a sufficient elevation to overcome the friction created by the passage of the water through the pipes, and to allow it to run into the upper stories of the dwelling-houses, the arrangement for the supply will be simple, and the annual expense beyond the interest of the capital expended will be trifling. It is, however, but seldom that such is the case.

In general the water has either to be raised from the rivers in the immediate neighbourhood at a great and continual expense of power; or, where there are no fresh-water rivers within a practicable distance, from deep wells; in which case the necessary power will be doubled; or, lastly, should there be a river in the neighbourhood, and it should be desirable to avoid the continual expense of steam power, it may be effected by bringing a cut from such part of the river that the elevation obtained by going a considerable distance up the stream produces a sufficient head without the aid of machinery, as in the case of the New River. The head is obtained thus: the natural fall of the river from whence the water is taken is so much greater than is necessary to produce the required velocity for the water through the canal, that the difference in levels makes the required head.

If an opportunity is afforded of adopting either the mode of bringing it from a distance by means of a canal, or by pumping from the river by steam power, the choice will be determined by the result of the estimate of the cost. The canal will cost more than the steam power in the first instance; and to determine which is the least expensive, the interest of the capital expended, added to the annual expense of keeping the canal in repair must be compared with the interest of capital expended for the steam power added to the annual amount for repairs, *and the cost of fuel and wear and tear of the steam power.*

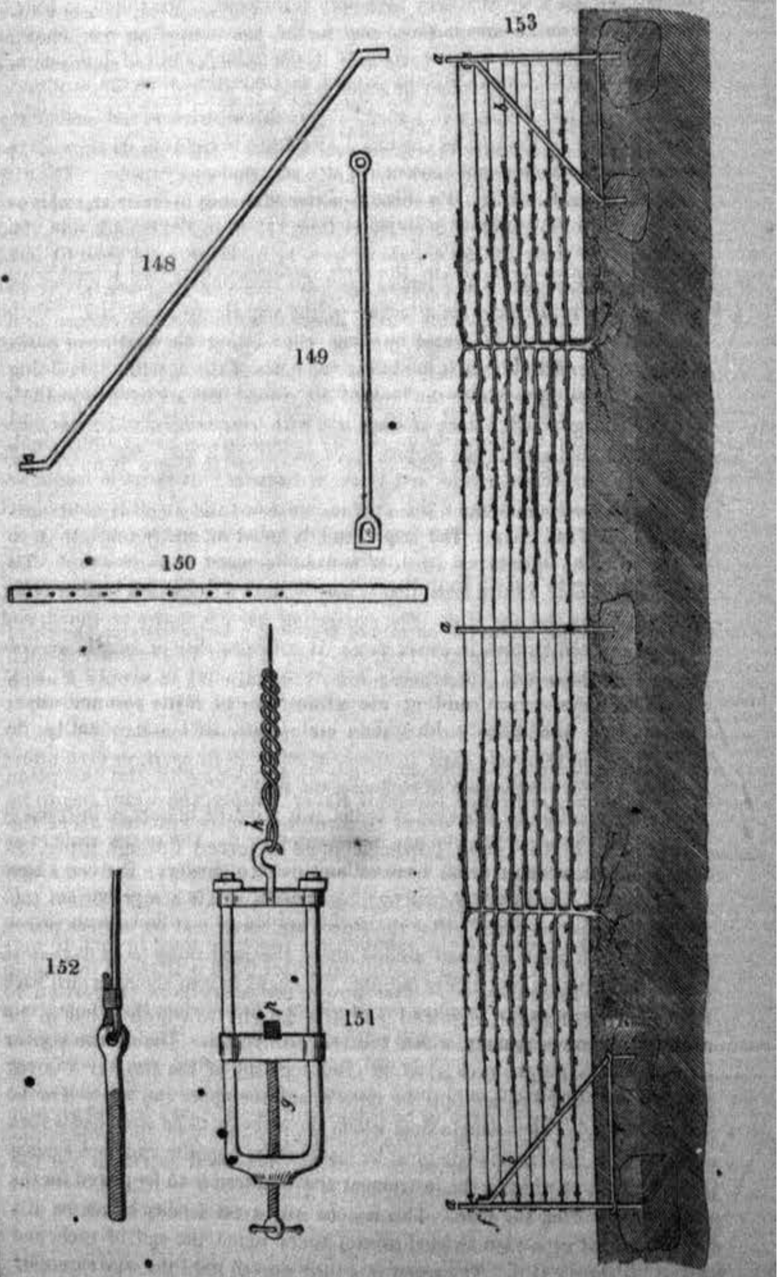
In small towns one line of pipes communicating with the source passes through the streets, and each inhabitant is supplied at the same time. In larger towns, where the number of houses to be supplied is great, and the distance that the water has to travel is also great, recourse is had to the following contrivance: in the principal streets mains are laid, which convey the water from the source; and branching from these mains, other smaller-sized pipes are laid, called services; at every point where the services branch from the mains a cock is attached, by means of which the communication with the main is either opened or shut off; from the services small lead pipes branch to each dwelling-house, and whenever the communication is opened with the mains, which *are always charged*, the houses whose lead pipes are joined on to the service receive a supply of water.

The necessity for such an arrangement will be made obvious by the following statement:

When water is forced through pipes either by a natural or artificial head, or by steam or other power, friction is created in proportion to the velocity of the water and length of the line of pipes. As the distance increases, the power must either be increased or the velocity reduced; the shorter the distance, the less the power required to overcome the friction; if, therefore, it is necessary to exert a great power to force the water to the extremities of an extensive district, that they may be properly supplied, it is very evident that the power which is exerted near to the source, not being required to overcome so great an amount of friction as at the extremities, must be applied to increase the velocity of the water through the orifices near the source; and if, therefore, such an arrangement as the one herein before mentioned were not adopted, the effect would be that those houses which were near the source would have a superabundant supply, while those at a distance would have a very small supply, if any; but, by means of the system mentioned, when the inhabitants near the source have received their supply the cocks on the services are shut down, and the water in the mains passes on to supply the services at the extremities, which will have a sufficient supply, because the water, not being used before, must pass on to the extremities. That each may have an *equal* supply, those that are near the source have the communication opened with the main for a shorter time than those at a distance, in proportion to the velocity with which the water is delivered.

In addition to this, on every line of mains and services orifices of about 2 inches diameter are made at certain distances, which are filled up with what are termed "fire plugs," being nothing more than wooden spigots made to fit the orifices; these are easily fitted and as easily removed, and in case of a fire they are started, and a supply is given directly. The strength of this supply is regulated by means of the system before mentioned; thus, by closing the service cocks in the other parts of the district, the whole force of the water may be concentrated in that part where the fire has occurred.

WIRE FENCES.



WIRE FENCES.

(From the Gardener's Magazine.)

At an ordinary meeting of the Horticultural Society of London, the following letter to the secretary from Mr. W. B. Booth, was read, upon the mode of constructing wire fences for training espalier fruit trees upon, and for other purposes.

"*Carclew, January* 29, 1839.

"Sir, I beg to hand you the following particulars respecting some wire trellises lately erected here, which you may, probably, not deem unworthy of submitting to the notice of the Horticultural Society.

"The object for which they are intended is the training of espalier fruit trees; and it occurred to me, in the course of erecting some wire fencing to divide a portion of the park, that a similar kind of erection might be advantageously introduced into the kitchen-garden, which would answer the same purpose as the expensive wooden or cast-iron trellises usually met with in those places where the espalier mode of training is adopted. I accordingly submitted the plan to Sir Charles Lemon, who has since had it carried into execution to a considerable extent.

"Wire erections of the kind I am about to describe are not uncommon, I believe, as fences, in some parts of the kingdom; but in Cornwall it is only within the last few years they have been introduced. Mr. Gilpin, in his excellent *Hints on Landscape-Gardening*, p. 217, has noticed the wire fence as being best suited for those parts near to the house, or to the approach, but he has not shown the manner in which it may be erected. The accompanying sketches and details will, I trust, supply this deficiency, and enable any one who may be desirous of erecting a wire fence or trellis to do so, with the assistance of a mason and blacksmith, at a very moderate expense. The wire used is known as No. 32. It is about a quarter of an inch in diameter, and is put up in large coils. Each wire measures from 115 ft. to 120 ft. in length. The main upright posts fig. 153 *a a* are of iron, 1¼ in. square, and from 5½ ft. to 6 ft. high, with holes 6 or 7 inches apart for receiving the small screws and nuts, to which the wires are attached in the way shown at fig. 152. At the opposite end the wire is secured by being bent a little at the point, and having a small wedge driven over it in each of the holes of the upright. Both these main posts are 4½ ft. above the level of the ground, and are fixed beneath the surface in large rough blocks of stone *d e*, with iron wedges, which are more convenient, and answer the purpose quite as well as if they were run in with lead. The stay-bar is round, and 1¼ in. in diameter, It varies in length according to the inclination of the ground, but when the latter is nearly level it is about 7 ft. long. The upper end is flattened, and beveled, so as to square with the upright, to which it is fixed by means of a screw at *f*. The lower end is only a little bent, that it may fit into a somewhat smaller block of stone *e* than the one at *d*. The connecting bar *c* is square or round, and need not exceed an inch in either case. It will also vary in length, according to circumstances. On a nearly level surface it must be about 5 ft. long, and have an eye at each end large enough for the end of the post and stay to go through. In addition to this, there are uprights of one-inch flat bar by half an inch in thickness fixed in stone, at 30 or 40 ft. apart, or even nearer if necessary, for the purpose of stiffening the trellis.

"In the erection of this kind of trellis, it is requisite to have an instrument for drawing the wires like the one represented at fig. 151 to the scale of an inch to a foot, which may be made without much difficulty. The one I have sketched was constructed by our own blacksmith, and is a very efficient contrivance for the purpose. After the stones are bored and set in their places, with the earth firmly rammed around them, the next thing to be done is to fix the main post *a*, and wedge it tight. It ought to lean about an inch back from the perpendicular, to allow for its giving a little when the whole strain of the wires comes upon it, which will bring it upright. The connecting bar *c* is then slipped down over it, while the lower end of the stay-bar *b* is put through the other eye and into the stone *e*, and the upper end screwed to the main post at *f*. The triangle from which the wires are to be stretched is then complete. A similar triangle must be made at the opposite end, and against the main post of which *p* the instrument above noticed is to be placed for the purpose of drawing the wire. This is done with great facility by means of a double piece of rope-yarn twisted several times round the end of each, and hooked, as shown at *h*. The screw *g* is then worked until the wire enters its proper hole in the post *p*, when it is bent and secured by a wedge, as already stated. The nuts on the bolts fig. 152, at the end from which the wires were drawn, are then screwed up a little, so as to make all the wires as tight as possible. The cost of the whole averages from 1*s.* 6*d.* to 2*s.* per yard.

"I have been thus minute with the details of the trellis and the mode of erecting it, in order that those who approve of it may be able to have others erected on the same plan, for either of the purposes to which it has been successfully applied at Carclew.

"I am, Sir, your very obedient servant,

"Wm. B. Booth."

STEAM BOAT PROPELLERS.

Sir—Whatever effect the experiments of Geo. Rennie, Esq., on steam-boat propellers, may have on the public generally, allow me to say, that I consider conclusions more erroneous were never before formed from any experiments, and with your permission I will attempt to prove, that the assertions relative to the superiority of the spear-shaped paddles are utterly without foundation. And what are these assertions, and what are we called on to believe? Why, that the floats of a paddle-wheel, when made in the shape of a trapezium, (with the acute ends down,) present double the resistance to the common rectangular floats with three times the width and equal area! A most important discovery certainly; and pray how is it that all our writers and experimenters on practical hydraulics have neglected to make known to us this peculiar but important property of the trapezium? Is it not for this simple reason, and this only, that they never could have discovered that such a property belonged to it? Indeed, it is a most glaring inconsistency to imagine that a flat surface, fashioned into a trapezium, can present double the resistance to a rectangular surface of equal area: we say that there is no authority whatever for the assertion, and happily for us Mr. Rennie has placed the proof within our reach.

We find, in the second table of experiments, (p. 25 of the Journal,) that a paddle-wheel of 3 ft. 3 in. diameter, with rectangular floats 9½×4 in., the total area of floats immersed being 228·8 sq. in., propelled the boat at the rate of 2·8 miles per hour, with 41·8 revolutions of the winch per minute. Also, that with trapezium-shaped floats, 9½×4 in. (the acute ends down,) and immersed area 107 sq. in., with a wheel 3 ft. 10¾ diameter, and 47·5 revolutions per minute, the same boat was propelled at the rate of 2·9 miles per hour.

In the first case, *i. e.* with rectangular floats, we shall find on calculation, that the centre of pressure, (assuming it in each case to be the centre of the floats,) travels at the rate of 382·9 ft. per minute, or 4·35 miles per hour, and the velocity of the boat is stated to be 2·8 miles per hour; the difference between these two quantities $(4{\cdot}35-2{\cdot}8)=1{\cdot}55$ miles per hour: this is the rate at which the floats, with an area of 228·8 sq. in. recede in the water, to obtain resistance sufficient to propel the boat at the rate of 2·8 miles per hour.

In the other case, *i. e.* with trapezium-shaped floats, we shall find, in the same way, that the centre of pressure travels at the rate of 466·3 ft. per minute, or 5·3 miles per hour, and the velocity of the boat being only 2·9 miles per hour, shows that the floats, having an area of 107 sq. in., recede at the rate of 2·4 miles per hour, to produce an equal resistance, (or nearly so) to the rectangular floats.

A writer in that excellent and useful publication, the Mechanic's Magazine, states the propeller to be "an important modification of the old paddle, being an ingenious application of a most simple and beautiful principle in nature," and mentions also the observation of the talented inventor, Mr. Rennie, "that nature never attains her ends but by the best and most efficacious means," meaning, of course, that the propeller in question is "the best and most efficacious." As Mr. Rennie seems to have followed *nature* so closely in his invention, it seems passing strange that he should have overlooked another of her principles, equally simple and important, viz. that of *the resistance opposed to the motion of a body through water being as the square of the velocity:* had he tested the performance of his floats by this simple law, he would have seen at once on which side the efficiency rested.

With the rectangular floats, we have seen that the recession, or the velocity of the floats through the water, is 1·55 miles per hour; the square of this is $1{\cdot}55\times1{\cdot}55=2{\cdot}4025$.

The recession of the trapezium-shaped floats is also shown to be 2·4 miles per hour, the square of which is $2{\cdot}4\times2{\cdot}4=5{\cdot}76$.

The *area* of the immersed floats necessary to produce an equal resistance in each case, is of course inversely as their velocity; and taking the area of the rectangular floats moving through the water at the rate of 1·55 miles per hour, at 229 sq. in., we find, by simple proportion, the area of the *same sort of float*, necessary to produce an equal resistance when moving through the water at the rate of 2·4 miles per hour, to be only 95·5 sq. in. for 5·76 : 2·4025 : : 229 : 95·5. Hence we see plainly, that had the *rectangular* floats been of equal area *only* with the trapezium-shaped floats, and *travelled at the same velocity*, the resistance would have been quite as great, if not greater; for the area of the immersed trapezium floats is stated to be 107, and the calculation shows that 95·5 sq. in. would have been sufficient with rectangular floats.

But we have no occasion to stop here; Mr. Rennie has tried the merits of the two kinds of floats on a larger scale, (viz. with the "Pink" steamer,) and we shall be able to show, that instead of being superior, the trapezium-shaped floats prove themselves to be infinitely inferior to the rectangular, as the experiments are made on a larger and fairer scale.

Pursuing the same method of calculation, we find that in the wheel with rectangular floats, the centre of pressure travelled at the rate of 754·8 ft. per minute, or 8·56 miles per hour, whilst the boat only travelled at the rate of 6·7 miles; then 8·56—6·7 = 1·86, for the recession of the rectangular floats with 635·6 sq. in. surface. The centre of pressure of the trapezium-shaped floats travelled at the rate of 829 ft. per minute, or 9·41 miles per hour, and the boat 6·34; then 9·41—6·34 = 3·07 for the recession of the trapezium floats per hour, having a surface of 432·25 sq. in. The square of 1·86 = 3·4596, and the square of 3·07 = 9·5249, then 9·5249 : 3·4596 : : 636 : 231 sq. in. Here we again see, that had the *rectangular* floats had an area of only 231 sq. in., and *travelled at the same velocity as the trapezium*, the resistance would have been equal! Whereas it appears by the experiment, that the area of the immersed trapezium-floats, was 432 sq. in., or (432—231 =) 201 sq. in. *greater* than would have been necessary with *rectangular* floats.

Thus far, then, we think we have proved all that we attempted, and now let us ask, what are the other advantages besides a reduced area, which are said to be derived for the use of the trapezium-shaped floats? A reduction of two-thirds in the width of the paddle-wheels and boxes. Having clearly shown that no advantage whatever is gained as far as the *area* of the immersed floats is concerned, but rather loss of power incurred; what authority is there for asserting that placing the floats endwise is advantageous? On the contrary, do not the experiments prove this modification to be as good as disadvantageous? for we see that when the obtuse angle was down, a surface of only 103 sq. in. was sufficient to propel the boat at the rate of 2·8 miles per hour, with only 46·5 turns of the winch, and a 3 ft. 6½ in. wheel; but when the acute angle was down, the velocity was only 2·9 miles, with 47·5 turns of the winch per minute, and a 3 ft. 10¾ in. wheel. In fact, there is just as much authority for stating, and I make bold to say, that the results would be found equally as favourable, were the common rectangular floats also placed endwise, as the trapezium floats are when in that position.

The disadvantages of the common paddle-wheel are universally acknowledged, and it would therefore have been much fairer, had Mr. Rennie compared the effects of the trapezium floats with the cycloidal or the vertically-acting paddle.

Above all, it may not perhaps be rude to ask, who are the competent judges and witnesses who are said to "have seen the experiments repeated again and again and *tested* them?" I think I may venture to say that Professor Barlow was *not* one of them, though he is said to approve of the plan *theoretically*.

In sending you my views on the subject, I trust I shall not be accused of any motive unworthy of the subject, or of endeavouring to cast a slur over the efforts of the talented inventor; but Mr. Rennie should recollect, that assertions coming from so high a quarter, are much more likely to mislead than when made by an obscure individual. If I am wrong in my views and calculations, it will be easy to discover the seat of error and thus elicit truth, and I shall then be the first to acknowledge it; but should this letter be the means of preventing a needless expenditure of money, I trust that those interested will consider that, instead of inflicting an injury, I have conferred on them a benefit.

I am, Sir,
Your obedient servant,
J. L.

Yewsley,
Jan. 9th, 1840.

TRAVERSING SCREW-JACK.

Fig. 1.—Side view.

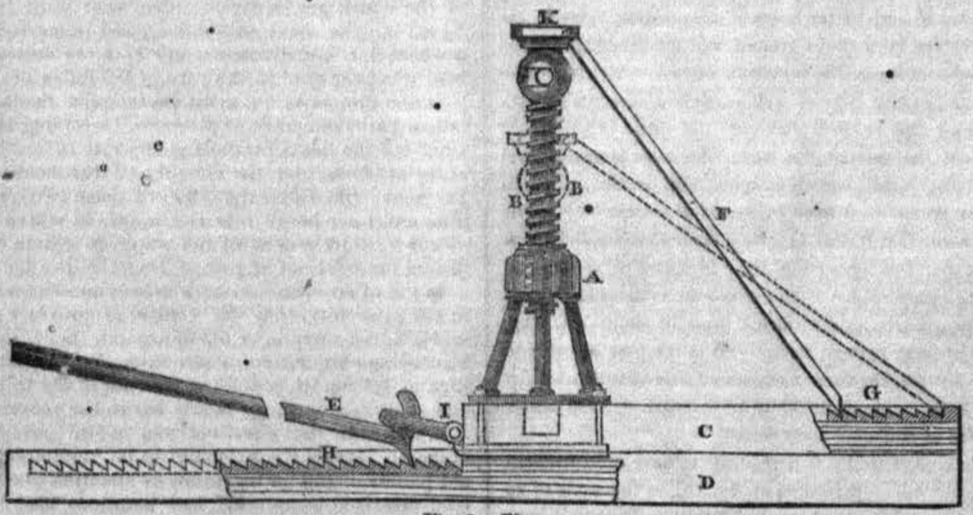
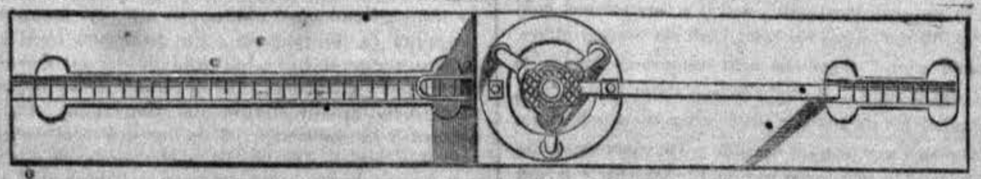


Fig. 2.—Plan.



TRAVERSING SCREW-JACK.

FIGURES 1 and 2 exhibit the screw modification. The screw-jack *a* is bolted to the plank *c*; at the other end of the plank is fixed the rack *g*, in which the toe of the strut *f* advances as the screw *b* is elevated; the strut works in a joint in the follower *k*: the position of the strut when the screw is depressed is shown by the dotted lines. The object of this strut is to relieve the screw of the violent cross strain to which the apparatus is subject, when the engine or carriage is pulled over by the lever; which strain is entirely transferred to the strut, and the screw has merely to carry the load.

The operation of traversing the jack is as follows: by hooking the link *i* upon the hook of the lever *e*, the toe of the lever being inserted into a ratch of the rack *h* of the lower plank, when a man, bearing down the end of the lever, drags the apparatus and engine or carriage towards him with great facility; the same lever is used to turn the screw, and to produce the traverse motion. By this apparatus an engine of 16 tons weight has been replaced upon the rails in five minutes by the engineer and stoker alone; thus those delays which are the subject of so much annoyance and loss to railway proprietors and the public, need not happen in future; the apparatus is exceedingly portable and cheap, and no train ought to be allowed to go out without its being sent along with it; it may be carried either upon the tender, or upon some other place which may be selected for it.

Plate 4.

M. DE LOSIER'S APPARATUS FOR RAISING WATER.

Fig. 3.

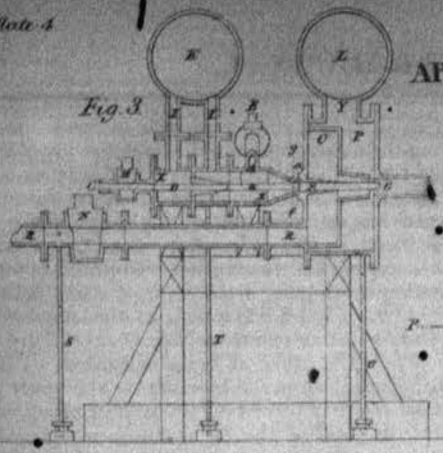


Fig. 9.

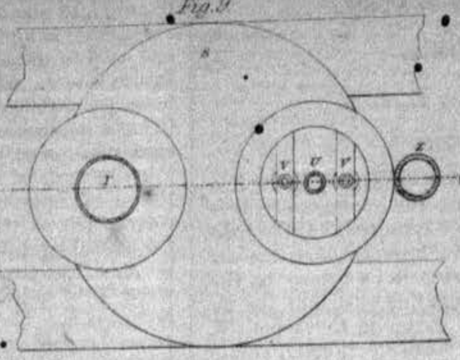
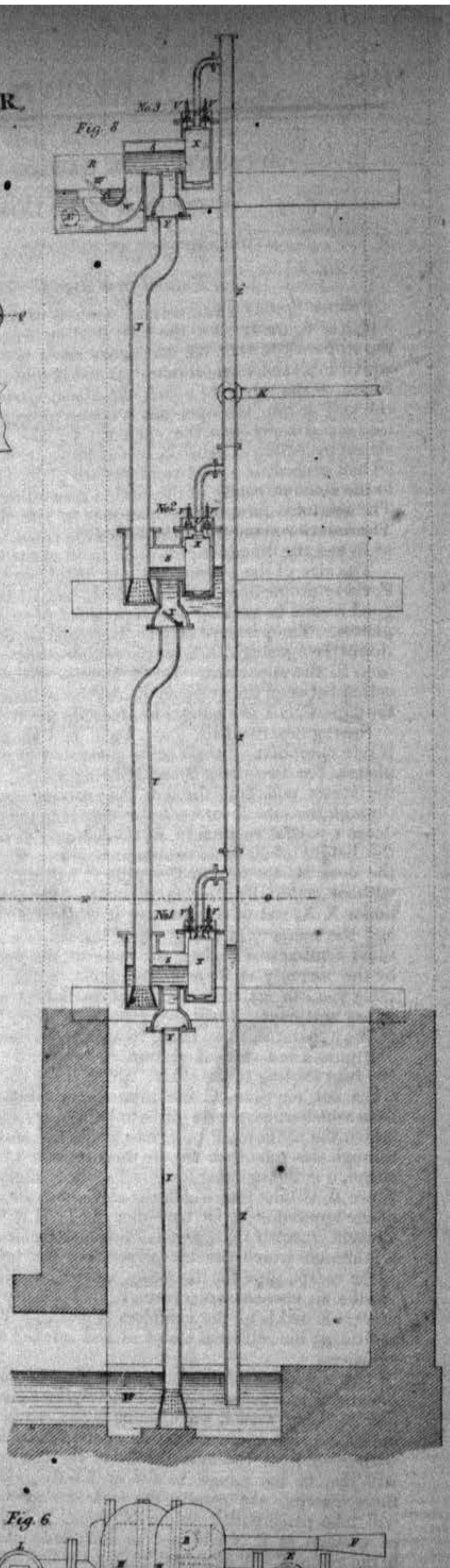


Fig. 8



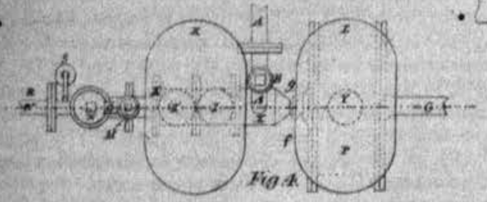


Fig. 4.

Fig. 5.

Fig. 1.

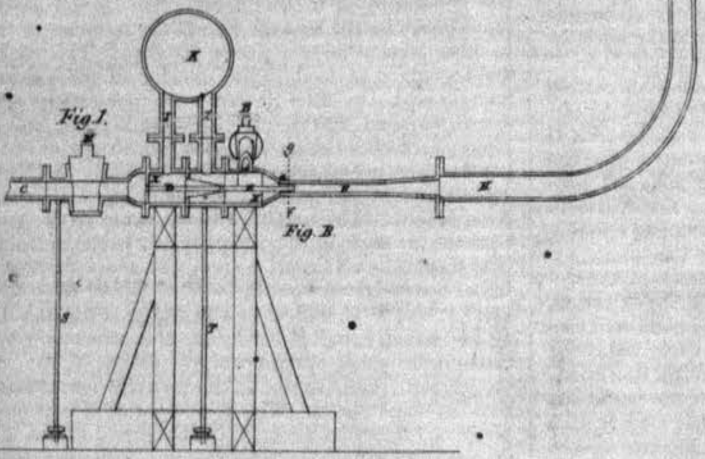


Fig. 2

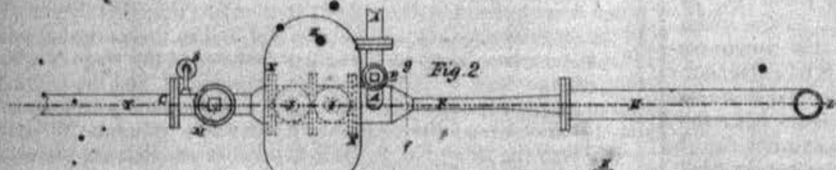


Fig. 7.

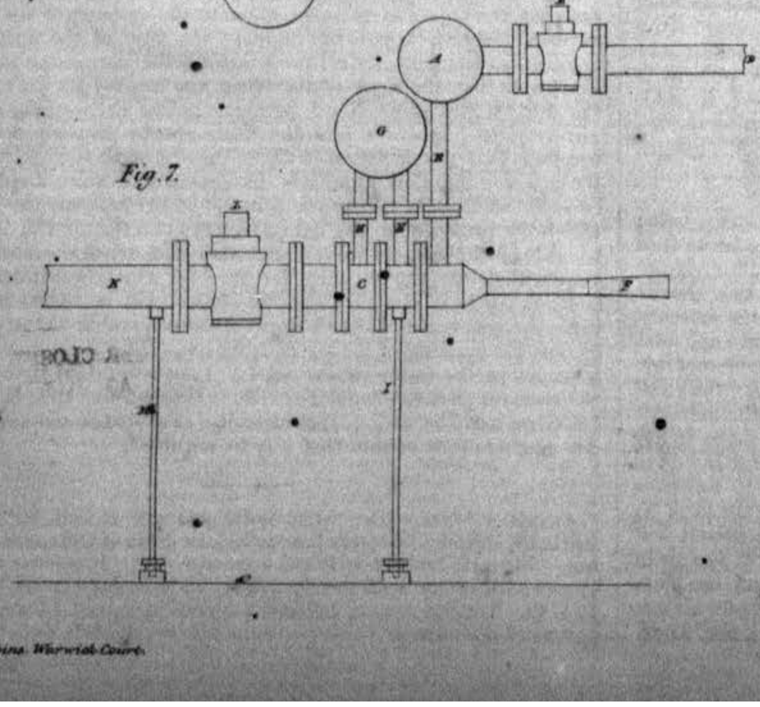
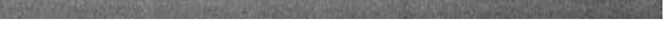


Fig. 6



J. R. Jobbins. Warwick Court.

APPARATUS FOR RAISING WATER.

Patented by M. De L'Osier.

ACCOMPANIED BY AN ENGRAVING, PLATE II.

Extract from Specification.

Figure 1, plate 2 is a vertical section of the apparatus, figure 2 is a plan of figure 1. A is the tube leading from the steam boiler, B is the stop cock to shut off the steam when not required. C the tube which I call the vacuum tube. D and E tubes through which the air flows. F the tube into which the steam passes in its escape to the chimney or into the open air, it is also through this tube that the air passes; *a* represents the openings for the steam in the pipe. F, shewn in section at figure 3, two of these openings are circular, parallel and concentric; the two others are plain, and their direction tends to the common centre of the circles, generating from the two others. The sectional form of the tubes may be varied to any form required. The interior diameter of the tube D is equal to from 14 to 15 of that of E, and the diameter of E of 15 to 18 of the tube F.

The size of the opening at *a* is about one-tenth of the size of tube F, these proportions may be varied, but I have found them produce good results in working with a pressure of steam equal to five atmospheres. The pressure may be increased or decreased by the regulation of the opening *a*, X X are the cylinders containing the principal parts used in the apparatus. K is a vacuum chamber, I I pipes communicating between the receiver K and the cylinder X X; M the cock in the pipe C, S T are gauges to ascertain the state of the rarefied air.

Having described the parts, I will now show the manner of putting it into operation. Steam being generated at a pressure of five atmospheres, the two cocks B and M being closed, on opening the cock B the steam will flow through the opening *a*, its continued passage through the tube F carries away the air in the cylinder X X, and produces a partial vacuum in K, the mercury of the gauge T will rise to the height of 50 or 55 centimetres above the cup, then on opening the cock M, the air in the pipe C will rush through the pipes D E without materially altering the state of the partial vacuum in the cylinder X X, and of the chamber K with which it is in communication, and the mercury in the gauge T instead of being depressed will rise some centimetres higher, the state of the vacuum will be indicated by the mercury at 30 centimetres above the cup. With this apparatus you can maintain a constant partial vacuum or removing of air in any recipient. I will now proceed to describe another modification of the apparatus, there being two vacuum vessels used in place of one.

Figure 4 is a vertical section, and figure 5 a plan of the same. A the tube leading to the steam boiler, B the cock to shut off the steam when not required, C the pipe communicating with the apparatus from which atmospheric air is to be withdrawn, D and E tubes through which the air flows, F tube into which the steam flows, and it is also through this tube that the air from the tubes D and E flows with the steam, *a* is the opening for the escape of the steam shown full size at figure B, G tube into which the steam and the air come from the part of the apparatus to be now described; R R is a tube leading to the vacuum chamber O, Q conical tube communicating with the chamber O, through which the air passes into the tube G by the pipe R, H is the escape pipe for the steam and air into the atmosphere, K and L are the air vessels or receivers, I I and Y are pipes connecting the receivers K and L to the cylinders X and P, S T and U are the gauges indicating the different states of the rarefied air, X X and P are the cylinders.

The operation of this apparatus is as follows:—The steam being generated to a pressure of five atmospheres, and the three cocks B M and N being closed, on opening B the steam will flow through the orifice *a*, by the continued action of the steam through the tube the air withdrawn from the cylinder X and the chamber K, and the mercury will rise in the gauge to 50 or 55 degrees above the cup, and there remain. On opening the cock M a constant withdrawing of air will take place with considerable velocity, at the same time the state of vacuum in K X will not be materially altered, and the mercury in the guage T will be raised higher, the continued action of the steam and air through the tube G rarefies the air in the receiver L, and in the cylinder P, and the mercury in the gauge U rises to 40 centimetres above that of its cup, and is kept there on opening the cock N, the air issuing from the chamber in connection with the tube R will flow through the conical tube Q into the tube G, the state of the air in the receiver L and the cylinder P is not at all changed, but the mercury in the gauge S will rise 30 centimetres, fresh supplies of air can be admitted as explained in the description of figures 1 and 2. A third air vessel may be used in a similar manner to the second when required, by admitting the atmospheric air through the pipes R R.

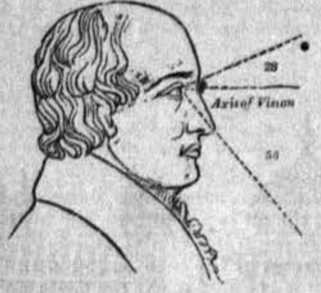
Figure 6 is a plan of the apparatus suitable for raising water from one level to another when worked by either of the apparatus shown in figures 1 to 5. Figure 7 is an elevation of the same, these having been previously described in the preceding drawings, I have not thought it necessary to repeat the description. Figure 8 is a vertical section of the exhausting or draining machine, from a line drawn from P to Q shown at figure 9. Figure 9 is a plan of the stage No. 1, as shown at figure 8, from a line drawn from N to O; S S S are the receivers placed one above the other at equal distances. T T T are the ascending tubes terminating in the receiver S; the lower part of the tube T of the stage No. 1 is placed on the well or other source of water Y Y, and the lower parts of the other tubes are placed in the receivers S. The number of these stages may be increased or decreased according to the height that the water is required to be raised. At the top of each of the ascending tubes T there is a valve Y; Z is the tube through which the air is withdrawn, the lower end of the tube is open and plunged in the water of the well Y Y, it is connected with the pneumatic apparatus by the tube K, and with the recipients S S S, by the small tubes U U U; X X X are the floats, and V V V are the air valves. In the top of the upper receiver S is attached a bent discharge tube W, closed by a valve W′; R is the reservoir for the water when raised, Æ shows where a pipe may be fixed to conduct the water to any place required.

To put this machine into operation, the cock E, figures 6 and 7 of the apparatus, is to be opened, the air and steam flowing into the atmosphere by the tubes F F, and the mercury of the gauge I will rise to 50 or 55 centimetres above its cup. The cock L is then opened, and the air contained in the interior of the exhausting machine will flow through the tube K across the pneumatic apparatus with great speed, at least 200 centimetres per second, and will flow into the atmosphere with the steam. The discharge of the air across the apparatus does not in any way affect the state of the vacuum, as may be ascertained by the mercury in the gauge I always remaining at the same height. The height of the mercury in the gauge M will always indicate the state of the air contained in the exhausting machine when it is about 31 or 32 centimetres; the receiver S of the stage No. 1 is full of water drawn from the well Y Y, the float X will then raise the small valves V Y, and close the orifice U for the discharge of the air against which it will be held fast, the atmospheric air being admitted through the small openings of the valves V, the valve Y closes, and the pressure on the water in the receiver forces it up into the receiver S of the stage No. 2. The same operation is performed in the stages No. 2 and 3 as that described with regard to No. 1, it is not therefore necessary to repeat the description. The air valves of the stages No. 1 and 3 are opened by their floats at the same time that they are closed in the stage No. 2, they will then be restored to their original position. The water when raised to the upper receiver at the stage No. 3, flows through the tube W into the large reservoir R, and the valve W′ is raised to allow it to pass freely, during this time the water again flows into the receiver of the stage No. 1. Besides this tube W in the receiver S of the stage No. 3, there is another which is not shown in the drawing, the object of it is to regulate the opening of the valve by means of a screw, in order to regulate the flow of the water in such manner that the float X shall press against the air escape pipe, at the same time that the float of the stage No. 2 raises its air valves, and the float of the stage No. 1 presses against the opening of the air escape pipe. In order that the floats should properly perform the functions that are assigned to them, they must be so constructed that the power which they require by the quantity of water displaced, will be sufficient to raise its proper weight, and to overcome the resistance which the pressure of the air exercises upon the air valves, and the weights of these same valves, and also that when the receivers are empty, their weight allowing for the part which is sustained by the water in the tube in which they are placed, will be sufficient to overcome the resistance of the pressure of the air, which keeps it pressed against the opening of the air escape pipe. The air escape pipe Z Z is placed in the water of the well Y Y, in order that if the water in the receiver (S S S) should flow into it through the tube U U, it may fall down into the well. This machine may also be worked by using any number of air vessels that may be required.

Artesian Well.—The boring instrument now at work for the Artesian well in the abattoir at Grenelle has reached the depth of 508 metres, or 1,666½ feet. The earth brought up is still a greenish clay. It requires 4 horses and 12 men to keep the apparatus in action; and it is daily hoped to see water burst up. The temperature increases a degree in warmth for every 30 yards penetrated downwards.

REVIEWS.

Repton's Landscape Gardening and Landscape Architecture, a New Edition. By J. C. LOUDON, F.L.S. London: Longman and Co., 1840.



HUMPHRY REPTON.

Humphry Repton was born at Bury St. Edmond's, May 2d, 1752, of a respectable family, and was originally intended for trade. At an early period he was thrown into contact with the Hopes of Amsterdam, a circumstance which perhaps decided the natural bent of his mind, and confirmed that love for the arts which forbade any other pursuit. After a long contest against his favourite studies, about 1788 he decided upon adopting the profession of a Landscape Gardener, a title which he created and maintained against those who decried its novelty. What was his success in this career it is unnecessary for us to mention, England abounds with his works, and he has left behind him a name which will live when the traces of his labours have vanished. His personal character powerfully influenced him in his artistical career, mild and amiable in his disposition, the same feelings seemed to influence his designs. Grandeur perhaps he rarely attained, but in producing scenes of cultivated and placid beauty, speaking at once of comfort and of wealth, he stood without a rival. He seemed as it were the genius born for cultivating the gentle slopes, and verdant meads of the sea-girt island, ever inspired with that love of the beautiful in nature, which marks the English character, fertile in expedient, he waged perpetual battle against the rude and unpicturesque, and powerfully contributed towards promoting that taste in landscape which has rendered this country the model of surrounding nations.

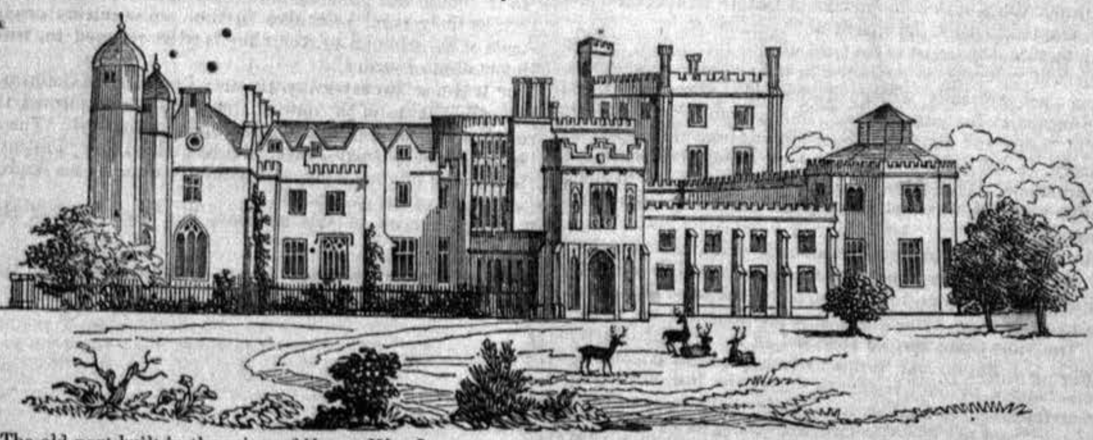
Repton's works consist of an agglomeration of fragments dispersed over one folio and three quarto volumes, now, however, collected by Mr. Loudon into one volume octavo. The service which Mr. Loudon has rendered by this task, cannot be too highly appreciated by the public, for he thus codified (as Bentham would have called it) the most valuable materials on the theory and practice of the art. Throughout these works a continual flow of originality of thought and beauty of idea seems to run from the pencil and pen of Mr. Repton, while the manner in which he exhibits its own personal interest in the subject give such a tone of identity as to resemble rather the warm breathing words of a professor than the cool notes of a closet writer. Repton is always present before us, and yet, instead of charging him with egotism, we receive him as a kindly guide and instructor. There are few portions of Milton more interesting than that where alluding to his blindness, we are personally introduced to an author whom we admire. Thus Repton alludes to some of his grievances.

"I cannot help mentioning, that, from the obstinacy and bad taste of the Bristol mason who executed the design, I was mortified to find that Gothic entrance built of a dark blue stone, with dressings of white Bath stone; and in another place, the intention of the design was totally destroyed, by painting all the wood-work of this cottage of a bright pea-green. Such, alas! is the mortifying difference betwixt the design of the artist, and the execution of the artificer."

"Such is the horror of seeing any building belonging to the offices, that, in one instance, I was desired by the architect to plant a wood of trees on the earth which had been laid over the copper roofs of the kitchen offices, and which extended 300 feet in length from the house."

To show the judicious observations of Mr. Repton relative to the architecture and alterations of old buildings, we select the following extracts from different parts of the work before us, and through the liberality of Mr. Loudon, we are enabled to give a few of the valuable illustrations.

FIG. 2.—ASHTON COURT.



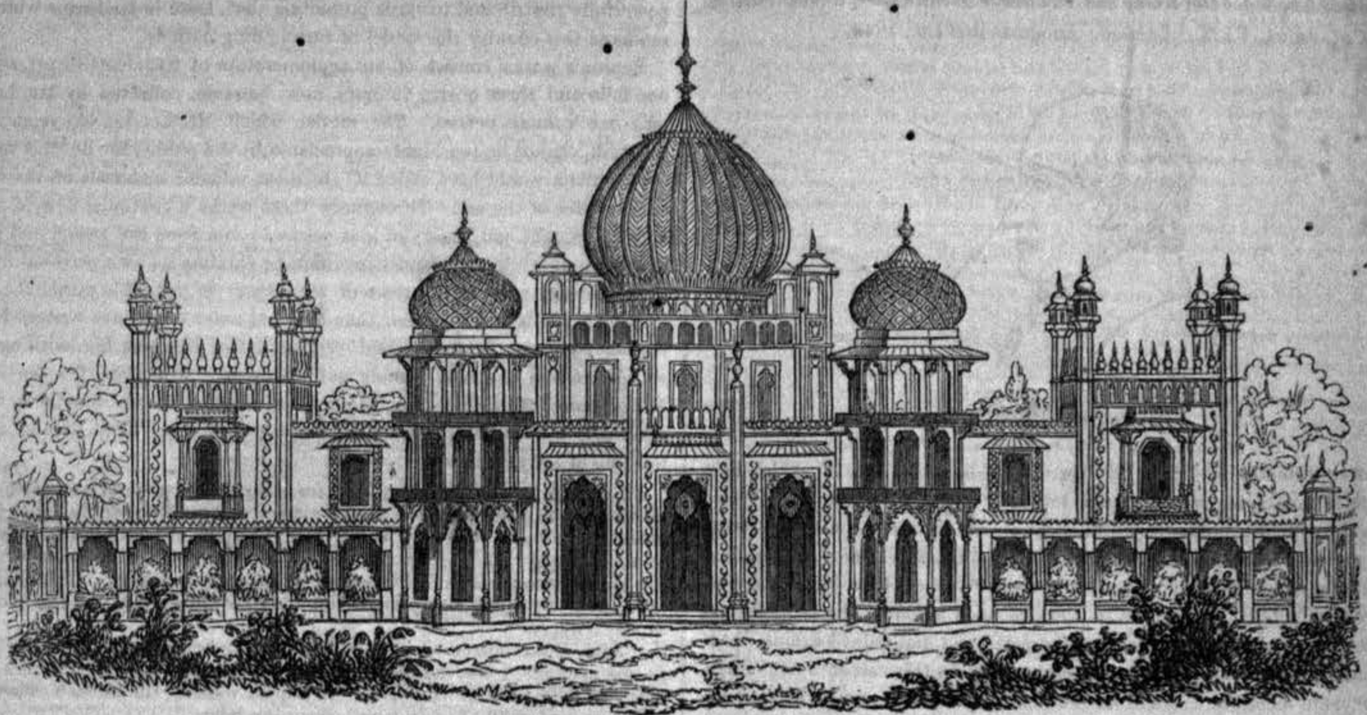
The old part built in the reign of Henry VI. The new part added in the reign of George III.

"The annexed engraving of Ashton Court, fig. 2, furnishes an example of making considerable additions to a very ancient mansion, without neglecting the comforts of modern life, and without mutilating its original style and character.

"This house was built about the reign of Henry VI., and originally consisted of many different courts, surrounded by buildings, of which three are still remaining; in all these the Gothic windows, battlements, and projecting buttresses, have been preserved; but the front towards the south, 150 feet in length, was built by Inigo Jones, in a heavy Grecian style; this front was designed to form one side of a large quadrangle, but, from the unsettled state of public affairs, the other three sides were never added, and the present long front was never intended to be seen from a distance: this building consists of a very fine gallery, which has been shortened to make such rooms as modern habits require; but it is now proposed to restore this gallery to its original character, and to add in the new part, a library, drawing-room, eating-room, billiard-room, with bed-rooms, dressing-rooms, and a family apartment, for which there is no provision in the old part of the mansion. It is also proposed to take down all the ruinous offices, and rebuild them with the appearance of antiquity, and the conveniences of modern improvement.

"A general idea prevails, that, in most cases, it is better to rebuild than repair a very old house; and the architect often finds less difficulty in making an entire new plan, than in adapting judicious alterations: but if a single fragment remains of the grandeur of former times, whether of a castle, an abbey, or even a house, of the date of Queen Elizabeth, I cannot too strongly enforce the propriety of preserving the original character of such antiquity, lest every hereditary mansion in the kingdom should dwindle into the insignificance of a modern villa."

FIG. 3.—WEST FRONT OF THE PAVILION.



Application of Indian Architecture.

"Having already shown the difficulty of adapting either the Grecian or Gothic styles to the character of an English palace, this newly discovered style of architecture seems to present a new expedient for the purpose, in the forms made known to this country by the accurate designs of Mr. Thomas Daniell, and other artists, which have opened new sources of grace and beauty.

"To the materials of wood and stone we have lately added that of cast-iron, unknown in former times, either in Grecian or Gothic architecture, and which is peculiarly adapted to some light parts of the Indian style.

"In Grecian architecture, the artist is confined to five (or, rather, only to three) different orders of columns, so restricted in their relative proportions, that they are seldom used externally, with good effect, in modern houses, and are generally found too bulky for internal use. Indian architecture presents an endless variety of forms and proportions of pillars, from the ponderous supports of the cavern, to the light, airy shafts which enrich their corridors, or support their varandahs. This alone would justify the attempt to adapt a style, untried, for the purpose to which other styles have been found inapplicable or inadequate.

"It is difficult for an artist at once to divest himself of forms he has long studied: this will account for the confusion of Grecian and Gothic in the works of John of Padua, Inigo Jones, and others, about the same date, which occasioned that mixture of style, condemned in after-times for the reasons already assigned. The same thing may be observed in the first introduction of Gothic, mixed with the Saxon and Norman which preceded it: and the same will, doubtless, happen in many instances, during the introductory application of Indian architecture to English uses, while a false taste will both admire and condemn, without any true standard, the various forms of novelty.

"If I might humbly venture to suggest an opinion on the subject, I should recommend the use only of such Indian forms or proportions as bear the least resemblance to those either of the Grecian or Gothic style, with which they are liable to be compared. If the pillars resemble Grecian columns, or if the apertures resemble Gothic arches, they will offend, by seeming to be incorrect specimens of well-known forms, and create a mixed style, as disgusting to the classic observer as the mixture in Queen Elizabeth's Gothic. But if, from the best models of Indian structures, such parts only be selected as cannot be compared with any known style of English buildings, even those whom novelty cannot delight, will have little cause to regret the introduction of new beauties.

"On these grounds, therefore, I do not hesitate to answer the question, concerning which I am commanded to deliver my opinion, that the Indian character having been already introduced (in part) by the large edifice at the Pavilion, the house and every other building, should partake of the same character, unmixed either with Grecian or Gothic; and without strictly copying either the mosques, or the mausoleums, or the serais, or the hill-forts, or the excavations of the east, the most varied and graceful forms should b selected, with such combinations, or even occasional deviations and improvement, as the general character and principles of construction will admit."

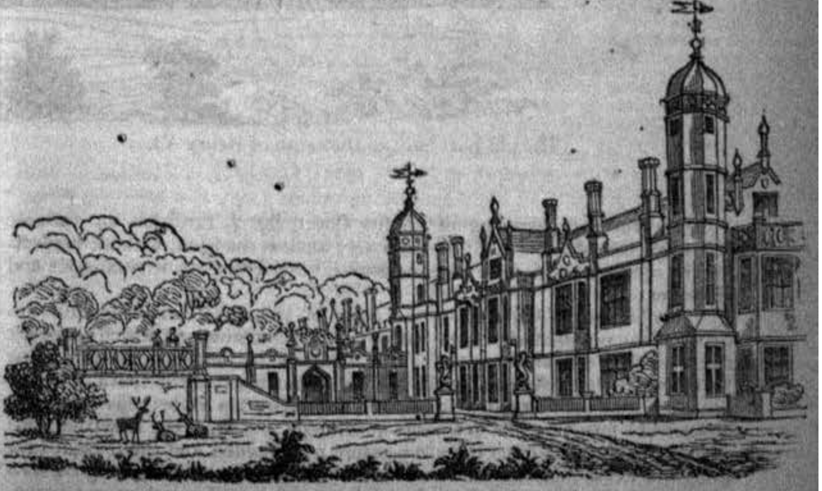
Concerning Cobham.

"Whether we consider its extent, its magnificence, or its comfort, there are few places which can vie with Cobham, in Kent, the seat of the Earl of Darnley; and none which I can mention, where so much has been done, both to the house and grounds. under my direction, for so long a series of years; yet, as the general principles in the improvements originated in the good taste of its noble proprietor, they may be referred to, without incurring the imputation of vanity.

"It is now twenty-five years since I first visited Cobham, where a large and splendid palace, of the date of Queen Elizabeth, formed the three sides of a quadrangle, the fourth side being open to the west. The centre building had been altered by Inigo Jones, who had added four pilastres without any attention to the original style, and without extending his improvements to the two long sides of the quadrangle.

"The interior of this mansion, like that of most old houses, however

Fig. 4—Entrance and north front of Cobham Hall, Kent.



adapted to the customs and manners of the times in which they were built, was cold and comfortless, compared with modern houses. A large hall, anciently used as the dining-room, occupied more than half the centre; and the rest belonged to the buttery and offices, in the manner still preserved in old colleges. The two wings contained rooms, inaccessible, but by passing through one to the other; and the two opposite sides were so disjoined by the central hall, that each was entered by a separate porch.

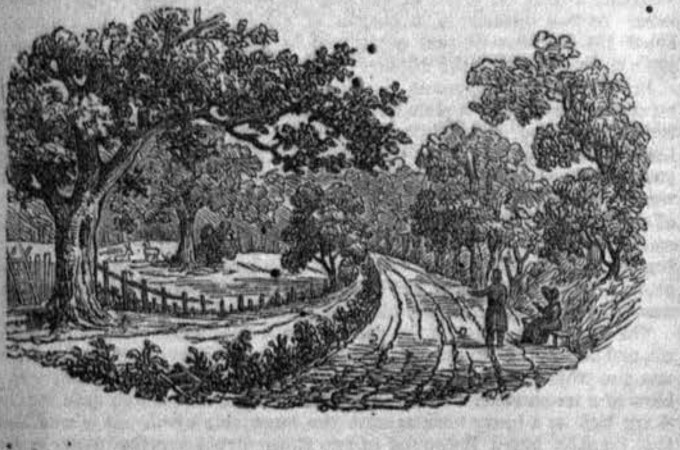
"The great hall at Cobham has been converted into a music-room, of fifty feet by thirty-six, and thirty feet high; and is one of the most splendid and costly in the kingdom, The rest of the central building forms the library, or general living room; which, instead of looking into an entrance-court, as formerly, now looks into a flower-garden, enriched with marble statues and a fountain, forming an appropriate frame, or foreground, to the landscape of the park. The entrance has been removed to the north front, under an archway, or *porte cochère,* over which a walk from the level of the picture gallery (which is up stairs) crosses the road, in the manner described by the annexed sketch, fig. 4, representing the north front, as it has been restored to its original character. In this view is also the bastion, by which the terrace-walk terminates with a view into the park."

We cordially agree with Mr. Repton in the following observations "*Concerning improvements.*"

"I have frequently been asked, whether the improvement of the country, in beauty, has not kept pace with the increase of its wealth; and, perhaps, have feared to deliver my opinion to some who have put the question. I now may speak the truth, without fear of offending, since time has brought about those changes which I long ago expected. The taste of the country has bowed to the shrine which all worship; and the riches of individuals have changed the face of the country.

"There are too many who have no idea of improvement, except by increasing the quantity, the quality, or the value of an estate. The beauty of its scenery seldom enters into their thought: and, What will it cost? or, What will it yield? not, How will it look? seems the general object of inquiry in all improvements. Formerly, I can recollect the art being complimented as likely to extend its influence, till all England would become one landscape garden; and it was then the pride of a country gentleman to show the beauties of his place to the public, as at Audley End, Shardeloes, and many other celebrated parks, through which public roads were purposely made to pass, and the views displayed by means of sunk fences. Now, on the contrary, as soon as a purchase of land is made, the first thing is to secure and shut up the whole by a lofty close pale, to cut down every tree that will sell, and plough every inch of land that will pay for so doing. The annexed two sketches, figures 5 and 6, serve to show the effect of such improvement; they both represent the same spot; formerly, the venerable trees marked the property of their ancient proprietor; and the adjoining forest, waste, or common, might, perhaps, produce nothing but beauty; now the trees are gone, the pale is set at the very verge of the statute width of road, the common is enclosed, and the proprietor boasts, not that it produces corn for man, or grass for cattle, but that it produces him rent: thus money supersedes every other consideration.

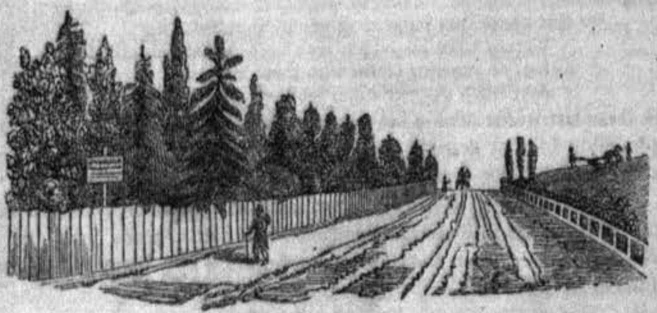
Fig. 5—View from a public road which passes through a forest waste.



This eager pursuit of gain has, of late, extended from the new proprietor, whose habits have been connected with trade, to the ancient hereditary gentleman, who, condescending to become his own tenant, grazier, and butcher, can have little occasion for the landscape gardener: he gives up beauty for gain, and prospect for the produce of his acres. This is the only improvement to which the thirst for riches aspires; and, while I witness, too often, the alienation of ancient family estates, from waste and extravagance, I frequently see the same effect produced by cupidity and mistaken notions of sordid improvement, rather than enjoyment of property. But, to whatever cause it may be attributed, the change of property into new hands, was never before so frequent; and it is a painful circumstance to the professional improver, to see his favourite plans nipped in the bud, which he fondly hoped would ripen to perfection, and extend their benefits to those friends by whom he is consulted.

"In passing through a distant county, I had observed a part of the road where the scenery was particularly interesting. It consisted of large spreading trees, intermixed with thorns: on one side, a view into Lord * * * * 's park was admitted, by the pale being sunk; and a ladder-stile, placed near an aged beech, tempted me to explore its beauties. On the opposite side, a bench, and an umbrageous part of an adjoining forest, invited me to pause, and make a sketch of the spot. After a lapse of ten years, I was surprised to see the change which had been made. I no longer knew, or recollected, the same place, till an old labourer explained, that, on the death of the late lord, the estate had been sold to a very rich man, who had *improved it;* for, by cutting down the timber, and getting an act to enclose the common, he had doubled all the rents. The old mossy and ivy-covered pale was replaced by a new and lofty close paling; not to confine the deer, but to exclude mankind, and to protect a miserable narrow belt of firs and Lombardy poplars: the bench was gone, the ladder-stile was changed to a caution against man-traps and spring-guns, and a notice that the foot-path was stopped by order of the commissioners. As I read the board, the old man said,—'It is very true, and I am forced to walk a mile further round, every night, after a hard day's work.' This is the common consequence of all enclosures: and, we may ask, to whom are they a benefit?

Fig. 6—View after the forest waste had been enclosed, and the ground subjected to agricultural improvement.



"'Adding to riches an increased store,
And making poorer those already poor.'"

Mr. Repton gives the following interesting testimony to his predecessor Brown, whose example he prided himself in following.

"Mr. Brown's fame as an architect seems to have been eclipsed by his celebrity as a landscape gardener, he being the only professor of one art, while he had many jealous competitors in the other. But when I consider the number of excellent works in architecture designed and executed by him, it becomes an act of justice to his memory to record, that, if he was superior to all in what related to his own peculiar profession, he was inferior to none in what related to the comfort, convenience, taste, and propriety of design, in the several mansions and other buildings which he planned. Having occasionally visited and admired many of them, I was induced to make some inquiries concerning his works *as an architect*, and, with the permission of Mr. Holland, to whom, at his decease, he left his drawings, I insert the following list:—

"For the Earl of Coventry. Croome, house, offices, lodges, church, &c., 1751.
The same. Spring Hill, a new place.
Earl of Donegal. Fisherwick, house, offices, and bridge.
Earl of Exeter. Burleigh, addition to the house, new offices, &c.
Ralph Allen, Esq., near Bath, additional building, 1765.
Lord Viscount Palmerston. Broadland, considerable additions.
Lord Craven. Benham, a new house.
"Robert Drummond, Esq. Cadlands, a new house, offices, farm buildings, &c.
Earl of Bute. Christ Church, a bathing-place.
Paul Methuen, Esq. Corsham, the picture gallery, &c.
Marquis of Stafford. Trentham Hall, considerable alterations.
Earl of Newbury. House, offices, &c., 1762.
Rowland Holt, Esq. Redgrave, large new house, 1765.
Lord Willoughby de Broke. Compton, a new chapel.
Marquis of Bute. Cardiff Castle, large additions.
Earl Harcourt. Nuneham, alterations and new offices.
Lord Clive. Clermont, a large new house.
Earl of Warwick. Warwick Castle, added to the entrance.

Lord Cobham. Stowe, several of the buildings in the gardens.
Lord Clifford. Ugbrooke, a new house.

"To this list Mr. Holland added: 'I cannot be indifferent to the fame and character of so great a genius, and am only afraid lest, in giving the annexed account, I should not do him justice. No man that I ever met with understood so well what was necessary for the habitation of all ranks and degrees of society; no one disposed his offices so well, set his buildings on such good levels, designed such good rooms, or so well provided for the approach, for the drainage, and for the comfort and conveniences of every part of a place he was concerned in. This he did without ever having had one single difference or dispute with any of his employers. He left them pleased, and they remained so as long as he lived; and when he died, his friend, Lord Coventry, for whom he had done so much, raised a monument at Croome to his memory.'

"I will conclude this tribute to the memory of my predecessor, by transcribing the last stanza of his epitaph, written by Mr. Mason, and which records, with more truth than most epitaphs, the private character of this truly great man:—

"'But know that more than genius slumbers here;
Virtues were his which art's best powers transcend:
Come, ye superior train, who these revere,
And weep the christian, husband, father, friend.'"

In these last words Repton has written at the same time his own epitaph, so admirably do they describe him as an artist and a man. At the head of this article is a profile of him, with a diagram illustrative of his doctrine of the theory of vision. He died as he had lived, quietly on the 24th of March, 1818, at Harestreet in Essex, his residence during latter years.

The following extract from his description tells in a few words the man and his character.

"Twenty years have now passed away, and it is possible that life may be extended twenty years longer, but, from my feelings, more probable that it will not reach as many weeks; and, therefore, I may now, perhaps, be writing the last Fragment of my labours. I have lived to see many of my plans beautifully realized, but many more cruelly marred: sometimes by false economy; sometimes by injudicious extravagance. I have also lived to reach that period when the improvement of houses and gardens is more delightful to me than that of parks or forests, landscapes or distant prospects.

"I can now expect to produce little that is new; I have, therefore, endeavoured to collect and arrange the observations of my past life: this has formed the amusement of the last two winters, betwixt intervals of spasm, from a disease incurable, during which time I have called up (by my pencil) the places and scenes of which I was most proud, and marshalled them before me; happy in many pleasing remembrances, which revive the sunshine of my days, though sometimes clouded by the recollection of friends removed, of scenes destroyed, and of promised happiness changed to sadness.

"The most valuable lesson now left me to communicate is this: I am convinced that the delight I have always taken in landscapes and gardens, without any reference to their quantity or appropriation, or without caring whether they were forests or rosaries, or whether they were palaces, villas, or cottages, while I had leave to admire their beauties, and even to direct their improvement, has been the chief source of that large portion of happiness which I have enjoyed through life, and of that resignation to inevitable evils, with which I now look forward to the end of my pains and labours."

The few extracts and illustrations we have given, justify us in saying that the mere collation and condensation of such a mass of materials as are contained in the work before us, would be alone sufficient to confer honour on Mr. Loudon, but his merit is still farther enhanced by the admirable manner in which the whole work has been illustrated and improved.

AN INSTRUMENT FOR ASCERTAINING THE AREA OF IRREGULAR PLOTS.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an Instrument for ascertaining the area of irregular plots, invented by Thomas Wood, M.D., of Smithfield, Ohio, Report:

That they have examined the instrument invented by Dr. Thomas Wood, and believe it to be novel and ingenious, and very simple in its construction. It consists of two plates of plain ground glass with their inner surfaces fixed in a frame, so as to be parallel to each other, and only so far distant as to permit a piece of drawing paper to slide easily between them. They are of a rectangular form, fastened on three sides in any manner which shall leave the surfaces parallel. The fourth side being open, the space within is partly filled with pure quicksilver. By means of a slip of drawing paper, the outer edge of the quicksilver is made straight and rectangular with the sides. Its position is then marked. This may be done by noting on the paper used, its distance from the outer and open edge of the glasses.

The plot of any irregular plot made from field notes or otherwise, is then moved in till the quicksilver extends to that point of the plot which is nearest the outer and open edge. The outer edge being now parallel to the former edge by the manner in which the paper containing the plot is cut, its distance from its former edge is measured or marked on the same paper, and the area of the irregular field is thus found to be the difference of the areas of two given rectangles.

The committee see no reason why such an instrument should not, when constructed with proper care, give results as accurate as those obtained by the common method of plotting, and dividing into right angled triangles by the dividers and plane scale. The area of the rectangle of any irregular plot, when once completed, may thus be formed in five minutes, and all danger of mistake from errors in the entries or in summing up the partial areas is completely obviated.—*Franklin Journal.*

DEPTH OF THE SEA.

Dr. Patterson read a paper at the American Philosophical Society, by Professor Charles Bonnycastle, of the University of Virginia, containing Notes of Experiments, made August 22d to 25th, 1838, *with the view of determining the Depth of the Sea by the Echo.*

The apparatus, which is fully described in Mr. Bonnycastle's paper, consisted, first, of a petard or chamber of cast iron, 2½ inches in diameter and 5¼ inches long, with suitable arrangements for firing gunpowder in it under water; secondly, of a tin tube, 8 feet long and 1¼ inch in diameter, terminated at one end by a conical trumpet-mouth, of which the diameter of the base was 20 inches, and the height of the axis 10 inches; thirdly, of a very sensible instrument for measuring small intervals of time, made by J. Montandon of Washington, and which was capable of indicating the sixtieth part of a second. Besides these, an apparatus for hearing was roughly made on board the vessel, in imitation of that used by Colladon in the Lake of Geneva, and consisted of a stove-pipe, 4½ inches in diameter, closed at one end, and capable of being plunged four feet in the water. The ship's bell was also unhung, and an arrangement made for ringing it under water.

On the 22d of August, the brig left New York, and in the evening the experiments were commenced. In these, Mr. Bonnycastle was assisted by the commander and officers of the vessel, and by Dr. Robert M. Patterson, who had been invited to make one of the party.

In the first experiments, the bell was plunged about a fathom under water and kept ringing, while the operation of the two hearing instruments was tested at the distance of about a quarter of a mile. Both instruments performed less perfectly than was expected; the noise of the waves greatly interfering, in both, with the powers of hearing. In the trumpet-shaped apparatus, the ringing of the metal, from the blow of the waves, was partly guarded against by a wooden casing; but, as it was open at both ends, the oscillation of the water in the tube was found to be a still greater inconvenience, so that the sound of the bell was better heard with the cylindrical tube. At the distance of a quarter of a mile this sound was a sharp tap, about the loudness of that occasioned by striking the back of a penknife again an iron wire: at the distance of a mile the sound was no longer audible.

In the second experiments, the mouth of the cone, in the trumpet apparatus, was closed with a plate of thick tin, and both instruments were protected by a parcelling of old canvas and rope-yarn, at the part in contact with the surface of the water. In these experiments the cone was placed at right angles to the stem, and the mouth directed toward the sound. The distances were measured by the interval elapsed between the observed flash and report of a pistol. At the distance of 1400 feet, the conical instrument was found considerably superior to the cylindrical, and at greater distances the superiority become so decided, that the latter was abandoned in all subsequent experiments. At the distance of 5270 feet, the bell was heard with such distinctness as left no doubt that it could have been heard half a mile further.

The sounds are stated in the paper to have been less intense than those in air, and seemed to be conveyed to less distances. The character of the sound was also wholly changed, and, from other experiments, it appeared that the blow of a watchmaker's hammer against a small bar of iron gave the same sharp tick as a heavy blow against the large ship's bell. It is well known that Franklin heard the sound of two stones struck together under water at half a mile distance; yet two of the boat's crew, who plunged their heads below the water, when at a somewhat less distance from the bell, were unable to hear its sound.

On the 24th of August, the vessel having proceeded to the Gulf Stream, experiments were made with the view for which the voyage was undertaken; that is, to ascertain whether an echo would be returned, through water, from the bottom of the sea. Some difficulties were at first presented in exploding the gun under water, but these were at length overcome. The hearing-tube was ballasted so as to sink vertically in the water. The observers then went, with this instrument, to a distance of about 150 yards from the vessel, and the petard was lowered over the stern, about three fathoms under water, and fired. The sound of the explosion, as heard by Mr. Bonnycastle, was two sharp distinct taps, at an interval of about one-third of a second. Two sounds, with the same interval were also clearly heard on board the brig; but the character of the sounds was different, and each was accompanied by a slight shock. Supposing the second sound to be the echo of the first from the bottom of the sea, the depth should have been about 160 fathoms.

To ascertain the real depth, the sounding was made by the ordinary method, but with a lead of 75 pounds weight, and bottom was distinctly felt at 550 fathoms, or five furlongs. The second sound could not, therefore, have been the echo of the first; and this was proved, on the following day, by repeating the experiment in four fathoms water, when the double sound was heard as before, and with the same interval.

The conclusion from these experiments is, either that an echo cannot be heard from the bottom of the sea, or that some more effectual means of producing it must be employed.

Dr. Hare suggested the expediency of employing the Galvanic fluid to fire gunpowder below the surface of water, in experiments similar to those of Professor Bonnycastle.—*Franklin Journal.*

THE SAFETY LAMP.

AT a late meeting of the Geological and Polytechnic Society of the West Riding of Yorkshire, Mr. Charles Morton placed on the table a variety of safety lamps, and proceeded to make some observations and experiments upon them. He called to the recollection of the members the attendance of Mr. Fletcher, of Bromsgrove, at one of the former meetings, when that gentleman produced and described a safety lamp constructed on an improved principle. Mr. Fletcher had since modified his lamp in accordance with the suggestions thrown out at that meeting, and the lamp which Mr. Morton exhibited had been sent to him by the inventor for trial in the coal mines. The novelty of the apparatus consists in a door or damper at the top, which is held up by a string tied fast to the lower part of the lamp. If this string be cut or burnt, the damper drops down and extinguishes the light, in the same way as the shutting of the damper on the top of a furnace chimney puts out the fire beneath. When, therefore, the lamp is introduced into an inflammable atmosphere, the combustion of the fire-damp inside burns the thread, and the damper dropping down destroys the flame. Mr. Morton thought the damper would give rise to so much trouble, that the colliers would not use it. The string is not very readily adjusted, and it passes so near to the wick, that a slight inclination of the lamp, or waving of the flame, burns the string, and the falling of the damper leaves the collier in darkness when he neither expects nor desires such a result; and to get rid of this annoyance he would prop up the damper, and effectually prevent its falling, even when it was desirable that it should do so, *i. e.* when it happened to be in a fiery part of the mine. In other respects, this lamp is much like the one invented by Upton and Roberts. The air for feeding the flame enters through the holes beneath, and is brought into immediate contact with the wick by means of a brass cup. The sides of the lamp are partly glass and partly brass, fitted together so as to prevent the admission of air. In Upton's lamp there is a wire gauze cylinder inside the glass, but in Mr. Fletcher's there is none. By this omission the light produced is much stronger, but the safety is materially lessened; for if the glass of Mr. F.'s lamp were accidentally broken, the naked flame would be exposed to the fire-damp, and an explosion would ensue. Mr. Morton stated that he had submitted this new lamp to a variety of experiments, both in and out of the coal mines, and he considered it deserving the attention of this society. He thought the invention was still capable of considerable improvement, and hoped that Mr. Fletcher (though a gentleman entirely unconnected with mining pursuits,) would devote more of his time and talents to the perfection of an apparatus, the ingenuity of which had already entitled him to the thanks of the public. Mr. Morton remarked that the necessity of attempting to improve the safety lamp would become more generally manifest, if it were universally known that Davy's lamp is *not safe* under certain circumstances. When "the Davy" is introduced into an inflammable atmosphere, *at rest*, it may be said to be safe; but if the lamp be in motion, or if a current of fire damp be directed upon it, there is great danger of explosion. By means of a gas jet on the lecture table, Mr. Morton caused the flame of "the Davy" to pass from the inside to the outside of the wire gauze cage; and he contended that, under similar circumstances, an explosion must inevitably ensue in a fiery coal mine; and he had no doubt some of the dreadful catastrophes that have occurred in the pits were occasioned in this manner. Mr. Morton said that the over zealous admirers of Davy had attributed a quality of infallible safety to an instrument which its illustrious discoverer never ventured to claim for it. On the contrary, this distinguished philosopher, in a treatise which he published more than twenty years ago on the subject of the safety lamp, distinctly points out its *unsafety* when introduced into an inflammable atmosphere in rapid motion; and he warns his readers against using "the Davy" under such circumstances. Mr. Morton was of opinion that if the notion which generally prevails about the absolute and certain safety of "the Davy" were dispelled, it would have a tendency to produce greater care and caution among miners. Mr. Morton, in conclusion, directed attention to an apparatus contrived by Mr. W. S. Ward, of Leeds, which he thought might be used for giving light to fiery mines, or in operations with the diving bell. The apparatus consists of a small gas-holder, containing a compressed mixture of coal gas and oxygen. To this is attached one of Hemming's safety tubes and a common jet, at the point of which is placed a ball of quick lime. The kindled flame of gas being directed upon the lime ball, a brilliant light is produced, and as the light is covered with a glass jar, the flame is rendered safe by being completely insulated or cut off from the external atmosphere.—*Midland Counties Herald.*

WINDSOR CASTLE.—About five or six weeks since a fissure was observed in the wall at the north-western extremity of the North Terrace, close to the Winchester Tower, the residence of Sir Jeffrey Wyattville. The opening on the northern side extended from the top of the wall to the surface of the earth on the outer side, a distance of some 20 or 30 feet; and on the western side, from the turrets down to the archway entrance to the vaults beneath, which extend under the whole length of the terrace. As soon as the fissure was discovered, workmen were employed to fill up the interstices (or "point" them) with mortar, in order to ascertain if the cracks would go on increasing. Within a very short period after this had been done, the opening not only widened, but extended along the lower pathway, parallel with the Winchester Tower, to a distance of 14 or 15 yards. The fissure now extends to a distance of upwards of 25 yards. Mr. Whitman, the clerk of the works, upon perceiving the dangerous state of the wall. lost no time in communicating with Sir Jeffrey Wyattville, who was then in London, on the subject, by whom the necessary instructions to proceed in such an emergency were immediately forwarded. Upon entering the vaults underneath the terrace, two large cracks were observable commencing from the bottom of the wall on the north side, extending completely across the arch, and terminating at the commencement of the outer wall of the Castle. These fissures were ordered to be "pointed" in the same manner as those on the outer wall, and with the same results; for after a few days the openings were found to be considerably enlarged. The first step determined upon was to ascertain how far from the foundation of the wall the injury extended, and workmen are now employed in digging a shaft within the arched vaults on the northern side for this purpose. As far as they have yet proceeded, so far extends the opening. It is feared, unless some plan be devised before the breaking up of the frost, to secure the immense mass of stonework which is now in so threatening and dangerous a state, that not only will a large portion of the terrace fall down the steep slope by which it is bounded on the north side, but that it will carry with it some thousands of tons of earth into the vale beneath, where is situated some stabling belonging to the canons of Windsor, and close to which is the extensive brewery of Messrs. Reid and Co., late Mr. Ramsbottom's. Some 12 months ago a deep trench or ditch was dug close to the New Terrace-wall, by order of the dean and canons of Windor, (to whom the slopes and a large piece of land on this side belong), for the purpose of receiving the water which runs off the terrace (after rains, &c.) through small gratings, and which, previously to this being dug, ran down the slopes upon their land below. The trench was intended to have turned the course of this water in another direction; but, instead of doing so, it remained in the ditch, where soaked into the earth, and thus, as it is generally supposed, sapped the very foundation of the wall itself, and thence the dangerous state of this part of the terrace, which was erected as long since as the reign of Charles II., who extended it westward upwards of 100 yards.—*Daily papers.*

ADAMS'S VERTEBRATED CARRIAGE.—On Monday, 10th December last, a vertebrated carriage, constructed according to the patent plan of Mr. Adams, with bow-spring bearers and buffers, for the Birmingham and Gloucester Railway Company, left the station at Euston Square with one of the trains for Birmingham. Much speculation had existed as to its action on the rails, owing to the various peculiarities of its construction, and especially from the circumstance that all four wheels were loose on the axles, in addition to the axles running as usual in the ordinary bearings. It has been hitherto found that carriages with loose wheels are apt to run off the rails at slight curves, but such proved not to be the case with the vertebrated carriage, which adapted itself to all curves with the greatest facility. In fact, it seemed almost impossible for the wheels to run off the rails, as the axles always disposed themselves at right angles to the line of traction, and the lateral yielding of the springs prevented any friction against the flanges of the wheels. Another objection which had been raised against the carriage, by persons connected with railways, was, that though it might be drawn forwards in a train, it could not be propelled, as the joint would yield, and the wheels go off the rails by an angular thrust. This opinion also proved fallacious, as the carriage was found to go equally well either way. The facility of draught was found far greater than that of carriages on the ordinary plan, though much larger than common, consisting of four bodies instead of three. The facility of its movement was strikingly illustrated at the Euston Station, where two of the wheels got off the turn-table, and escaped from the rails. The usual course in such cases is to raise a common carriage by means of screw-jacks, but owing to the action of the joint, and the free movement of the wheels, the vertebrated carriage was rolled upwards by the labourers with little apparent difficulty, without resorting to mechanical aid. We understand that it is intended to run the carriage between London and Birmingham, previous to the opening of the Gloucester Railway, and judging from its satisfactory performance in remedying various railway evils, there seems to be little doubt that this plan of carriage will come into general use. We understand that another improvement by Mr. Adams will shortly be brought forward, consisting of a more perfect lubrication of the axles by means of oil instead of grease, and without the usual waste, so that a carriage will probably run a week with only once oiling. We apprehend that the saving of friction on the wheels, owing to the free revolution independent of each other, will materially increase their durability.—*Railway Times.*

COLLEGE FOR CIVIL ENGINEERS.

In the year 1838, our attention was aroused to a correspondence which had crept into the Times and Athenæum, attempting to lower the character of the profession in this country, and to set up a foreign standard. We rightly surmised that this was a coming event, which cast its shadow before it, that it was the wish father to the thought, which was to usher in some expedient to correct the assumed abuse, and introduce the new doctrine. Accordingly we hastened to attack the new-born hydra, and on repeated occasions expressed our sentiments relative to their new school of error. Remarks upon this subject will be found in volume the first, page 369, and volume the second, pages 13, 86, 124, 152, and 354. On account of this solicitude for the interests of the profession, we were assailed in a violent manner by the advocates of the projected College; what they gained by the attack our readers know.* In the meanwhile, the plan has been brought to light, a scheme of operations organised, and active preparations made for carrying them into effect. While the intentions of its managers were not publicly declared, and while they had yet the opportunity of adopting a sane course, and according to the wishes of the profession, we left them to carry on their designs in peace. Now that the mask has been lifted—now that war has been delared against the whole profession, and that an open attempt is made to poison the public mind with error, we feel it our bounden duty to call the serious attention of our readers to the mischievous and fallacious objects, which it proposes to effect. In this investigation, we shall enquire, first, as to the mode of education required by the profession; secondly, as to how far this is supplied; next, as to the merits of the proposed plan; fourthly, how it has hitherto succeeded, and what are its future prospects; and lastly, how far it might be rendered useful.

We have, on previous occasions, already defined engineering,† as a profession requiring two distinct faculties, the theoretical and practical, the inventive and the constructive. This is a view sanctioned by the highest authorities. The Report of the Institution of Civil Engineers for 1837,‡ describes the engineer as a mediator between the philosopher and the working mechanic. In their Report for 1838,§ they say, "The objects of the Civil Engineer are defined by your charter, and the council considering that the success and permanency of the Institution must depend, in a great measure, on the care exercised in admission into this class, have repeatedly considered this subject with the view of presenting some definite rules for the guidance of themselves and others. It has appeared that they will be aided in this difficult task by adhering as much as possible to the two following conditions; either:—"

"He shall have been regularly educated as a civil engineer, according to the usual routine of pupilage, and have had subsequent employment for at least five years in responsible situations as resident or otherwise in some of the branches defined by the charter as constituting the profession of a civil engineer; or, he shall have practised on his own account in the profession of a civil engineer for five years, and have acquired considerable eminence therein."

"It is thought that the first condition will include those who by regular education have done their utmost towards themselves for the profession, and that their subsequent employment in responsible situations will be a guarantee that they have availed themselves of the opportunities which they may have enjoyed."

"In the earlier days of the science of the civil engineer, such a condition would have been inapplicable; then the force of native genius sufficed to place the individual in that position of professional eminence which commenced with a Brindley and a Smeaton, and was in our own time exemplified in a Rennie and a Telford. To such, of whom there are many illustrious examples amongst us, the second condition is strictly applicable."

The profession, particularly in its present infant state, is ever called upon to provide for unexpected contingencies, to make new precedents, and supersede old processes. The last ten years has seen a new and important branch created, and scarcely established, before it found itself, by new improvements, obliged to abandon all its former calculations, and follow new models. The profession, therefore, is well defined as of two classes, and as uniting two branches of instruction. The accessory portion of instruction is one common to most practical pursuits, and a part of higher education at the same time, consisting as it does, of the mathematical and physical studies, it needs no excathedral inculcation, but admits of being attained by private study by those engaged in the practical department. Like literature, like the arts, it necessarily follows, that its greatest names are not recruited from apprentices to the system, but from every class of society, it admits the collegian and the mechanic; every man, who feels himself called upon by the divine voice to a destined pursuit. Who have been our greatest engineers? not students from a college, or an apprenticeship, but the stone mason and the blacksmith, the labourer and the millwright. Engineering is not like law, bound up in an endless mass of precedents, admitting few new cases, and fearful of diverging from established rules, but it is ever new, ever changing, ever supplanting the past, by anticipations of the future. It does not, like medicine, require the study of a complicated and little known machine, nor a special application of many difficult sciences to its own objects, it does not require mere judgment to apply old rules, but it perpetually encounters new cases, and applies new remedies. The records of its operations are hardly published when they become useless and superannuated; many branches are hardly sufficiently advanced to have any literature at all; consequently, for those seeking practical instruction, the workshop and the field are the only schools; the house cannot be judged by a brick, the sea cannot be measured by a bowl of water, nor can the operations of the engineer be taught on any other scale of truth than on that of the works themselves. The lawyer and the surgeon find no college allsufficient for their instruction, they find not even the court house or the hospital alone efficient, but under the care of the acting practitioner, they are obliged to seek the basis of their education. It is remarkable indeed that a departure should be attempted in this sound course, when other professions are even carrying it to a greater extent; so distrustful are the medical authorities of oral instruction, that they now require at their examinations practical dissections and manipulations.

Engineers may be classified under the following heads:—

1. Civil Engineers—Roads and Railways.‖
    Canals.
    Bridges.
2. Mining Engineers—Mines.¶ Draining.
3. Marine Engineers**—Ship Building.
    Harbours.
    Docks.
    Light-houses.
    Dykes.
4. Military Engineers.
5. Practical Engineers—Land Engines.
    Locomotive Engines.
    Marine Engines.
    Manufacturing Engines.

Subsidiary to these are Surveyors, Working Engineers, Locomotive Engineers, and Steam Vessel Engineers. The instruction required for these classes, we consider to be a practical acquaintance with the details of the technical portions, to be acquired under the guidance of practical men in actual operations, and a study of the accessory sciences connected with their pursuits. Ample instruction in the former department is to be obtained from the existing engineers; and with regard to supplementary education, numerous institutions exist, independently of the amount of knowledge communicated by mechanic's institutions and other sources. The Institution of Civil Engineers, and the Universities of London and Durham, and the Military Colleges grant degrees, and classes are formed in London at University and King's College, in those of Norwich, Chatham, Sandhurst, and Addiscombe, and Hanwell Collegiate School; in the Provinces, in the Colleges of Durham and Bath, the Cornish Mining School, the Scotch Naval and Military Academy, at Edinburgh, the Royal Dublin Society's School, at Dublin, the Agricultural School, at Templemoyle, King William College, Isle of Man, and Elizabeth College, Guernsey. The elements of surveying are taught in many of the schools for the middle classes.

We have now to consider the proposed plan of the College for Civil Engineers, which assuming different principles, calculates upon supplanting the existing modes of instruction. These are given to the public in a pamphlet, the confusion and ridiculousness of which, for the present, we pass by unquestioned and unremarked. This prospectus boldly asserts, that with regard to the demand for efficient practitioners in civil engineering, not one of our Universities or public seminaries has kept pace with this want of the age, and afforded a suitable education for the aspirants in that new profession; —the best answer to this is to be seen above. What they mean by the following, they themselves can best explain. "They are, in a great measure, responsible for the profits on our internal industry—on the average of which depend agricultural returns, and also by reaction, an increased demand for labour." The fundamental basis of operations is that the whole instruction, both theoretical and practical, shall be given in the College. This, according to the account of its managers, includes the structure of railways, roads, canals, docks, locks, and harbours, improvement of rivers, clearing mines of water, and their necessary ventilation; the whole structure of the steam engine, land and water transport, architecture and general construction, naval architecture, mining, drainage, embanking, reservoirs, light-houses, arsenals, surveying, levelling, mineral boring, modelling, casting and forging, turning and boring. And what is to feed this multitude?—two loaves and five small fishes—a few professors of mathematics, drawing and latin, an architect, and some acres of ground at Hampstead!!! Is there any one so insane as to attempt to carry out such a scheme?—is there any parent so wasteful of his own money, or regardless of the interests of his child as to entrust him to such a school? In an arena, scarcely fit for a cricket match, are we to see exemplified the wonders of British art; here, by magic processes, are to be reproduced *ad infinitum* the Grand Trunk Canal, the Eddystone Light-house, the Steam Engine, the Menai and Waterloo Bridges, and Birmingham Railway, with its vallied cuttings, its Kilsby tunnels, and its hilly embankments. The Clifton Bridge would span the ground, the Camden Town Embankment, swallow up the soil, and the cutting to Euston Square take in the whole estate. "Philosophy in sport, made science in earnest." We are either to believe these delusions, or we must recognise the sad reality, children mis-spending their father's money and their own time on mimic railways, and gutter canals; expert in all the verbiage which a well disciplined memory can retain, and going out into the world the children which they came into the college. If this be the offspring of the Polytechnic School, an Institution which has flourished under some of the noblest men in France, we believe that, with indignation, they will disavow their bantling; if it be an imitation of Russia, it is an imitation rather of the barbarism, than of the grandeur of that nation; we know that no example in favor of it exists in any other country. In the workshops, South Wales, Birmingham, Glasgow and Newcastle are to be united; the steam engine is to be wrought, by boys, from the native ore into all its wonderful applications as a motive power. What more they profess to teach we know not, we know that all these things, even if practicable as toys, will fail to make engineers such as England has and England wants. The ignorance of the projectors is only equalled by their absurdity; the manner in which the design is to be carried out, is expressed by a synopsis of the course of instruction extending over a peaiod of five years, in the first two years of which the pupils learn nothing of engineering, except surveying and levelling, their principal acquirement being caligraphy; in the second year we find these branches are taught in conjunction with mineral boring and draining, and the principles of Civil and Naval architecture. No progress has yet been made in engineering but never mind, we can wait. The third year advances to shaded and coloured drawing, drainage, embanking, and conduct of running water, and the construction of roads; leaving, consequently, the whole instruction for the last two years. In this course, we find that the principal engineering works (*i.e.* treatises) of the English, French, and Germans are to be read. What those French and German works are we should very much like to know;—to the best of our knowledge very few works exist, except translations from the English. Among the *magna opera* of the last year, we find such terms as "a grand drawing, with plans, sections, and parts in detail;" "grand project for internal transport by land or water, with estimates;" "a memoir on some important question of civil engineering." The pennyworth of bread to these gallons of sack, is the examination and explanation of public works on the works themselves. The "lucidus ordo" of the synopsis must be evident to the most unsystematical; drawing and caligraphy interpolated between mechanics and hydrography; architecture between hydrography and physics, and the same impartial system is carried throughout. As to the workman's class, for which twelve guineas a year is to be charged, the paltriness and inadequacy of instruction given exempts it from notice. The pupils may be admitted into the high school at fourteen years, and on going through the prescribed course of instruction, as any youth of moderate abilities and sufficient memory is sure to do, is turned out on reaching his eighteenth birth-day, a duly qualified successor of Brindley, Smeaton, Rennie, Telford, and Watt.

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* Vol. ii. p. 124.
† Vol. i. p. 369, and Vol. ii. p. 124.
‡ See Journal, vol. i. p. 138.
§ Vol. ii. p. 73.
‖ Ingenieurs des Ponts et Chausees, French.
¶ Ingenieurs des Mines, French.
** Ingenieurs des Travaux Maritimes, French. Water Staat, Dutch.

This system, we may observe, is a clumsy imitation of the Polytechnic School, and other similar Institutions abroad, which are adopted in the imperfect state of instruction, to supply the want of a more practical course. In the Polytechnic or Gwerbe School, the student finds those models which he can find with difficulty elsewhere, but under the guidance of a Stephenson or a Maudsley, he learns in that school, which is the model to all Europe. In our pages[*] will be found an account of the state of engineering abroad. What it is here all Europe tells; we boast the names of Middleton, Worcester, Hooke, Savery, Newcome, Brindley, Milne, Smeaton, Bell, Edwards, Arkwright, Rennie, Macadam, Bramah, Huddart, Trevithick, Telford, Woolf, and Murdoch; and among the engineers of the present day:—Walker, Stephenson, the two Rennies, the two Brunels, Cubitt, Locke, Maudsley, Tierney Clarke, &c., many of whom enjoy an European reputation. Such are the fruits of a defective system; what has Europe to show against it? The same defective system prevails in the United States, where gigantic works of the engineers measure the continent from one end to the other.

As to what must be the result of the proposed system, we fear we can augur nothing very good, on one side they are deficient in strength, and on the other side they have to compete with powerful rivals. The plan of the College itself, and its details, have been rendered ridiculous by fantastic absurdities; the very first page of their prospectus is calculated to excite laughter;—a College for Civil Engineers, plastered with the names of a set of Eton schoolmasters, as honorary members; unknown foreigners, as corresponding members; the prospectus is dashed throughout with unmeaning italics; the distinguishing absurdities of the Hone and Black Dwarf School; the vice of those, who wanting strength of thought, make it up by variety of type. One of the professorships is to be held by a clergyman of the church of England, another is the chaplain, and sectarianism is openly proclaimed in a building devoted to the national pursuit of science. Of what religion were the Marquis of Worcester and Watt? "The College is based upon the principles of the established Church." Church of England railways, Catholic steam engines, and Presbyterian canals, whoever heard of such things? Could not the moral and religious instruction of the students be provided for without injuring the feelings of large masses of the population, by giving a preference to a minority? The food of the boarders will be of the best description, and every care taken of their health!—shades of Brindley, Arkwright and Rennie, whoever heard of such superfluous nonsense! "No pupil can be admitted without a certificate that he has had the small pox, or has been vaccinated; and has no particular infirmity or contagious malady." "He must be able to read! and write! fluently, and be master of the first four rules of arithmetic!!" "Corporal punishment will not be permitted in the establishment!" —"Suppose a gentleman designs one of his sons, at the age of five years!!! to be a civil engineer."

As to the supporters of this College, we find many men of high title, but we look in vain for the support of any of the great men, who, by their engineering works, have contributed to their country's glory. Only three names are to be found qualified as engineers, none of whom are sufficient to attract of themselves public support. As to the professors, of whom, by the bye, there are none for engineering, it is saying enough for them to mention, that many of the names are respectable.

We now come to another question of the deepest interest to those parents, who are so ill advised as to send their children to this rickety College, that is, what is to become of the lads when they have got their diplomas? Will they be employed by the present engineers in preference to their own pupils?—will they have greater weight with the public, than men of acknowledged eminence?—will they be supported by the public like those who have received a practical education under first-rate men? Our impression is, that they will not, but that the lads will, after their five years of College education, and an expenditure of several hundred pounds, be obliged to pitch their diplomas into the Thames, and article themselves to those who know something of the profession. We earnestly call on all who may be tempted by the luring proposals of destining children from the cradle, and hatching engineers with more than an Eccaleobion power, to pause and reflect on the waste of time and money which they must incur from any failure of this kind, and to hesitate before they become the victims of a few deluded theorists. So sanguine are the projectors, that they talk of entrapping hundreds of lads, and think nothing of a hundred engineers as the average produce of a year. This, according to our reckoning, would of itself produce three thousand engineers, besides those educated in other establishments;[†] and what is to become of the raw and ignorant youths?—those best will be able to decide, who can coolly give utterance to such preposterous delusions.

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[*] Vol. i. p. 369.

[†] As to how they are to support the competition of the engineers and existing colleges, its managers may know better than we pretend to do. They will be able to solve whether Everett, Webster, Wallace, and Elmes are equal to De Moran, Silvester, Lardner, and Graham, or to Hall, Moseley, Daniell, Wheatstone, Phillips, Bradley, Cooper, and Tennent.

As to the manner in which they are supported by the profession, it may perhaps be sufficient to refer to the men connected with it, but we have farther public testimonials in the declarations of the Institution of Civil Engineers. The liberality of their opinions we have already shown, so that anything emanating from them, carries with it the whole weight of their character, and is free from the imputation of interested motives. Their Report for 1837,* while advocating the necessity of supplementary instruction, states that much has at times been said respecting the establishment of a School of Engineers, and many comparisons have been drawn betwixt the advantages possessed by this and other countries in this respect, but not for an instant to enter on the great question of the nature of a complete establishment under that name, it may with confidence be asserted, that this Institution is in itself a School of Engineers—a school not in the sense of the term where knowledge is forced upon the unwilling student, but one where the attentive student possesses remarkable opportunities of self-improvement by study and mutual intercourse. In the speech of the President, on opening the Session of 1839,† he calls upon the members to improve themselves, not by collegiate instruction, but by mutual improvement; he says, "there is now upon the table, a prospectus for the establishment, on a large scale, of a College for Civil Engineers," leaving his hearers to form their own opinions upon the merits of such proposition.

That there is room for the establishment of a school of engineering on sound principles, it admits no question; but its sphere, although extensive, is very different from that contemplated by the present plan. Its advocates jump at once to conclusions, inspired by the ardent hope of obtaining large premiums, they jumble everthing together, and mix up the practicable with the impracticable. Stephenson or Brunel carry on no trade in premiums of five hundred guineas, it would make little diminution in their incomes, if they had no pupils at all, but young men are sent to them because from their employment in large works, they have great facilities in affording instruction, and ample means of employing them afterwards. If the council of the College want to know what to do with their establishment, we can tell them how it may be made useful to the public, and profitable to themselves and their pupils. Let them require that every pupil in civil mining, marine or practical engineering shall be articled to a practitioner, and let them like University, King's, and Durham Colleges, limit themselves to teaching the theoretical branches. Form a special class for instructing steam vessel engineers, and they may claim a government grant and a class for locomotive enpineers, and railway companies would probably contribute. Educate surveyors, and instruct them in the higher branches of geodesiacal operations, not as planned by the College, merely the rudiments of astronomy, but its application in trigonometrical surveying. Give supplementary education to mining engineers, and train up mineralogists and assayists. Teach like King's College, the literature of manufactures and machinery, but let the pupils study in the factory instead of the toy-shop. Do the same for the manufacturing chemist, London has establishments enough for his practice. Let the Universities or the Institution give the diploma, and limit the College to teaching, and still will be done more than enough for a beginning, and what will amply pay for all expenses.

In concluding these remarks, we cannot too strongly repeat, that parents should hesitate before they compromise the interests of their children, by sending them to this establishment, and we call on its managers to pause in their career, before they have yet excited the open hostility of the profession, and to devote their energies to a useful and rational purpose, before they are crushed by a powerful opposition. We have been influenced by no prejudice against the College or its objects, but we feel that we have best done our duty both to it and our readers, by unsparingly denouncing what we consider an erroneous and inefficient system of education, and a certain delusion to those who have the misfortune to be its victims.

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* See vol. i. p. 138.
† See Vol. ii. p. 3.

Oxford University.—Few persons are aware that 100,000*l.* was left to the University of Oxford by Michael Angelo Taylor, to build a picture gallery and lecture rooms connected with science and arts. A dispute having arisen between his relatives and the trustees respecting the will, the latter, rather than risk a suit in Chancery, have agreed to take 75,000*l.*, and have begun clearing the foundation for the building. They have removed the old houses at the corner of Beaumont-street, St. Giles's, nearly opposite St. John's college, which is the most central they could meet with.

GENERAL THEORY OF THE STEAM ENGINE.

By Aristides A. Mornay, Esq.

No. V.

On the Action of the Steam in the Cylinder (continued.)

In our last number we demonstrated that the pressure exerted by the steam against the piston may be assumed in practice as equal to its full elastic force; we intend in a future paper to enter into an investigation of the elastic force of the steam at different instants during the stroke of the piston, preparatory to which it will be necessary to inquire into the effects of an arrangement, which exercises a material influence on the elastic force of the steam during a portion of the stroke of the piston when it is adopted: we allude to the *lead of the slide*, which is considered indispensable in Locomotive Engines.

The *lead* is the advance given to the motion of the slide, by which it is caused to shut the eduction port, and open the steam port a little before the commencement of the stroke, and to shut the steam port and open the eduction port a little before the end of the stroke.

In order to explain the reasons assigned for giving a lead to the slide in locomotive engines, we think we cannot do better than quote the following from the description of Stephenson's Patent Locomotive Engine, in Weale's splendid edition of "Tredgold, on the Steam Engine," pages 450 and 451 of the Appendix. "It is found necessary to let the steam on to the opposite side of the piston before the end of the stroke, in order to bring it up gradually to a stop, and diminish the violent jerk that is caused by its motion being changed so very rapidly as five times in a second. The steam, let into the end of the cylinder, before the piston arrives at it, acts as a spring cushion to assist in changing its motion, and if it were not applied, the piston could not be kept tight upon the piston rod. A little lead of the slide is also necessary that the steam may be admitted through the port into the cylinder, and be completely ready to begin the next stroke when the piston is at the end of the cylinder; but so much is not necessary for this.

"The principal advantage gained by giving lead to the slide is in beginning to get rid of the waste steam before the commencement of the stroke; so that when the piston commences its stroke there is but little waste steam before it to resist its progress, the steam beginning to be let out of the cylinder before it has driven the piston to the end of the stroke. This is a very important point in a locomotive, as the resistance or negative pressure of the waste steam upon the piston is very considerable; from the rapidity of the motion, which allows very little time for it to escape, and from the use of the blast pipe, which obstructs its passage. The area of the extremity of the blast pipe is only five square inches, while that of the steam port is eight square inches, requiring the velocity of the steam in the blast pipe to be considerably greater than in the cylinder. The average negative pressure of the waste steam throughout the stroke is 6 lbs. per square inch when running at the usual rate of 25 to 28 miles an hour; and at greater velocities the negative pressure has been found to increase to double that amount and even more."

From the first reason the evil it is intended to remedy by the lead of the slide appears to be, the tendency of the piston to become loose on the piston rod, through the violent jerks caused by the motion of the piston being changed so very frequently as 5 times in a second. We have to ascertain first, the immediate cause of the jerks, secondly, the manner in which they occasion the piston to work loose, thirdly, their force, and lastly, in what manner and to what extent this is diminished by the lead of the slide.

In order to account for the production of these shocks or jerks, we will consider what passes in the cylinder of a locomotive engine, and first on the supposition that the steam acts on the piston with its full pressure to the very end of the stroke, and that it is then shut off and immediately begins to press with its full force on the other side of the piston.

On this head it is necessary to observe that, under the circumstances here assumed, the steam could not, at the instant the piston commences the stroke, press upon it with its full force (that is, with the same force as in the middle of the stroke), on account of the necessity of first filling the steam passage and waste space at the end of the cylinder. But, since the pressure of the steam remaining in these waste spaces does not sensibly exceed that of the atmosphere, while the fresh steam admitted into them has a very great excess of pressure, say 50 pounds on the square inch, the time required to fill them is certainly very much less than that required to fill one hundredth part of the contents of the cylinder, during which time the steam is pressing upon the surface of the piston with a force increasing from the atmospheric pressure to the maximum pressure attained during the stroke. With respect to the gradual opening of the port, that would not of itself affect the pressure of the steam in the cylinder in any degree, since the degree of opening is constantly proportional to the velocity of the piston, by which means the supply of steam is always equal to the demand. This is equally true while the steam-port is being closed in the last half of the stroke. We may therefore be permitted to assume, as above, that the steam presses on the piston with its full force during the whole time that the steam-port is open.

We may also, for the sake of simplicity, assume the motion of the crank to be strictly uniform; for the variations of power are so exceedingly slight in comparison with the energy of the moving mass, on account of the arrangement of the two cranks, that no sensible variations in the velocity of the engine can possibly result therefrom.

Under these circumstances, when the piston has just arrived at the middle of the back stroke, its motion may be regarded for an instant as uniform, since it is changing from an accelerated to a retarded motion; the strain on the key which connects the piston to the piston-rod is therefore equal to the effective pressure of the steam on the piston *minus* the friction of the latter against the surface of the cylinder. But as soon as the piston has passed the middle of its stroke, its motion begins to be retarded, and since the retarding force has to be transmitted from the piston-rod to the piston through the medium of the key which connects them, the latter has to bear the strain of this force in addition to the pressure of the steam on the piston, which it had to bear in the middle of the stroke. This retarding force must evidently increase from the middle to the end of the stroke with the rate of retardation of the piston's motion. The strain at the end of the stroke will therefore be equal to the effective pressure of the steam on the surface of the piston, *minus* its friction, *plus* the greatest retarding force, since the retardation is then the most rapid. At the commencement of the fore stroke, the pressure of the steam is equal on both sides of the piston, and there is consequently no power to move the piston but such a portion of the momentum of the engine as is sufficient to overcome the inertia and friction of the piston. The former requires a force precisely equal to the retarding force at the end of the stroke, so that the strain is suddenly diminished by the effective pressure of steam on the piston *minus* twice its friction; and the remaining strain is gradually, though quickly, taken off by the escape of the waste steam allowing the steam on the other side of the piston to exert sufficient force to accelerate its motion. From the moment when this is the case all the pressure is borne by the conical end of the piston-rod, until it arrives at the corresponding point of the back stroke, from which the strain on the key increases gradually until it attains its maximum at the end of the stroke, as we have already explained.

In locomotive engines, where the steam is used at very high pressures and the pistons are light, the strain due to the retardation of the motion of the piston is very inconsiderable in comparison with that due to the pressure of the steam, as we shall presently prove, when we calculate the intensity of the retarding force; so that comparatively very little increase of strain takes place during the last half of the stroke, this increase being due to the retardation of the piston alone, while the increase during the first half amounts, as we have already mentioned, to the whole effective pressure of the steam; for by the time the piston has passed through the first half of the stroke, the pressure of the waste steam must be reduced very nearly to that of the atmosphere.

The shocks complained of appear therefore to be due, not to the inertia of the piston requiring a considerable force to change its direction, but to the alternate action of the steam on the two sides of the piston producing a strain on one side of the key which reaches its maximum at some point of the *back* stroke, and is taken off entirely during the *fore* stroke.

The mode in which this intermittent strain on the key may cause it to work loose is evidently by the alternate compression and relaxation of its substance; but the effect of this might be prevented by securing the key with a screw in the same manner as the key at the crank end of the connecting rod.

We have said that the chief part of the strain on the key of the piston is due to the pressure of the steam; this investigation would however be incomplete without a calculation of the strain due to the inertia of the piston in consequence of the great variations in its velocity. This strain is evidently equal to the force which would be required to produce a certain acceleration or retardation in the motion of the piston, and an accelerating or retarding force is proportional to the rate of acceleration or retardation which it produces.

Let $V =$ the mean velocity of the piston in feet per minute, $l =$ the length of its stroke, $v =$ its velocity at any given instant, $\lambda =$ its distance from the end of the stroke, $a =$ the angle contained between the crank and the direction of the stroke, and $x =$ the rate of retardation per minute, at the given instant.

Supposing, for the sake of simplicity, that the motion of the crank is strictly uniform (which is very nearly true in reality), and that the connecting rod is infinitely long in comparison with the crank, the circumferential velocity of the crank pin will be $\frac{\pi V}{2}$, and we shall have

$$v = \frac{\pi V}{2} \sin. a,$$

whence we obtain by differentiation

$$d\,v = \frac{\pi V}{2} \cos a\, d\,a.$$

The actual distance to be passed through by the crank pin before it arrives at the dead centre is $\frac{l}{2}a$, which divided by its velocity $\frac{\pi V}{2}$, gives for the time required to travel that distance

$$t = \frac{l\,a}{\pi V},$$

whence

$$d\,a = \frac{\pi V}{l}\, d\,t.$$

Substituting this expression in the value of $d\,v$, and dividing by $d\,t$, we obtain

$$\frac{d\,v}{d\,t} = \frac{\pi^2 V^2 \cos a}{2\,l} = \frac{\pi^2 V^2 (l - 2\lambda)}{2\,l^2}.$$

And since this quantity expresses the retardation of the piston per minute, we have also

$$x = \frac{\pi^2 V^2 (l - 2\lambda)}{2\,l^2}.$$

The retardation per minute produced by the force of gravity is about 115,884 feet, which if we call G, we shall have

$$\frac{x}{G} = \frac{\pi^2 V^2 (l - 2\lambda)}{231768\, l^2}.$$

If then we call w the weight of the piston, and W the pressure due to the retardation x, we shall evidently have

$$\frac{W}{w} = \frac{x}{G} = \frac{\pi^2 V^2 (l - 2\lambda)}{231768\, l^2},$$

or the strain on the key of the piston is equal to the weight of the piston multiplied by the quantity $\frac{\pi^2 V^2 (l - 2\lambda)}{231768\, l^2}$.

As an example let $V = 500$, $l = 1{\cdot}5$, and $\lambda = \frac{1}{48}$. Supposing the driving wheels of the engine to be 5 feet in diameter, the speed under these circumstances would be 29·75 miles per hour. The strain W on the key of the piston is required, when the latter has arrived at a quarter of an inch from the end of the stroke, which is the lead usually given to the slide in locomotives. By the preceding equation we have

$$W = w\,\frac{\overline{3{\cdot}1416}^2 \times \overline{500}^2 \times \frac{35}{24}}{231768 \times 1{\cdot}5^2} = 6{\cdot}9\, w.$$

On inspecting the general equation given above, it will be evident that, all other circumstances remaining the same, the value of W varies as the square of the velocity of the piston, and that it increases as the piston approaches the end of the stroke, the strain at the very end being equal to the weight of the piston multiplied by the quantity $\frac{\pi^2 V^2}{231768\, l^2}$. Under the circumstances assumed in the above example we should therefore have at the end of the stroke

$$W = 7\, w.$$

It likewise appears that, with various lengths of stroke but the same velocity, the strain is inversely as the length of the stroke, when the piston is at proportionate distances from the end.

The same calculation applies, of course, as well to the first as to the second half of the stroke of the piston, and is improperly omitted in the consideration of the unequal action of the steam on the crank and the effect of fly-wheels; but in these calculations it is not only the weight of the piston, but that of all the alternating parts of the engine, that must be taken into account. In the same manner the strain on the key which connects the piston-rod with the cross head is a multiple of the weight of the piston and piston-rod, and so on for the other joints. It is, however, necessary to deduct first in each case the friction on the piston and other parts which may intervene between it and the joint under consideration.

Since the strain calculated by the preceding method is due simply to the inertia of the piston, it is clear that, in order to find the whole strain, it will be necessary to increase the former by as much as the pressure of the steam against the surface of the piston may exceed that of the waste steam on the opposite side.

We have now to examine the manner in which the force of the shocks is diminished by the lead of the slide, and to what extent this remedy is effectual.

We shall confine our reasoning on this subject to locomotive engines, in which, as we have already observed, the strain brought upon the key of the piston by destroying the momentum of the latter, is very slight in comparison with that which results from the pressure of the steam on the piston, and which the key must necessarily bear during some portion of the stroke; for, supposing the effective pressure of the steam to be 50 pounds on each square inch of the piston, the area of the latter being upwards of 113 square inches when its diameter is one foot, the total pressure of the steam on its surface is more than 5600 pounds, while the strain due to the inertia of the piston, being under seven times its weight; if we suppose this to be 70 pounds, (which we believe to exceed the truth) is less than 490 pounds, or less than one-tenth part of the strain due to the resistance of the load, deduction being made for the friction of the piston. The connecting key of the piston must therefore unavoidably bear a strain of more than 5000 pounds while the steam is acting with its full force, besides that due to the inertia of the piston, which amounts, at one quarter of an inch from the end of the stroke, to 69 seventieths of the maximum strain due to that cause; and, since this is less than one-eleventh of the total strain at the end of the stroke, when no lead is given to the slide, the greatest amount which can be saved by cutting off the steam and admitting it on the opposite side of the piston at a quarter of an inch from the end of the stroke, is no more than one-seventieth of the strain due to the inertia of the piston, or less than one 700th part of the total strain at the moment of cutting off the steam.

It is therefore evident that the sudden jerks experienced by the key which connects the piston with the piston-rod, in consequence of the rapid changes in the motion of the piston, in as far as they are due to the inertia of the latter, do not afford a sufficient motive for giving a lead to the slide; and that this remedy is entirely ineffectual in diminishing them, in as far as they are due to the alternate action of the steam on the opposite sides of the piston, which is the immediate cause of nearly the whole amount of the evil; so that, if the piston could not be kept tight on the piston-rod without the lead, neither could it be with a lead of a quarter of an inch, when the length of the stroke is 18 inches.

Regarding the second reason, namely, that the steam may be admitted into the cylinder, and be completely ready to begin the next stroke when the piston is at the end of the cylinder, we are of opinion that nothing at all is gained in that respect by means of the lead, but that, on the contrary, it is attended with a slight disadvantage. Near the beginning of this paper we observed that, without any lead, a loss of pressure during a very small portion of the stroke ensues from the necessity of filling the waste space at the end of the cylinder with steam at the beginning of the stroke; but this loss is of very trifling amount. By a lead of one quarter of an inch this loss of pressure is avoided, for this gives sufficient time for the waste space to be filled with steam at full pressure by the commencement of the stroke; but by this means the resistance on the opposite side of the piston is increased, during the last quarter of an inch of the stroke, by whatever pressure the steam has acquired at every instant of that portion of the stroke. The amount of resistance so produced is greater than the loss of pressure at the beginning of the stroke resulting from the abovementioned cause when there is no lead. We do not, however, attach any importance to this circumstance, as the whole amount of loss either way is perfectly insignificant; we only mention it to show that the lead of the slide is not requisite, nor even advantageous, for the second reason assigned by the author of the paper above quoted.

With respect to the third reason, we do not think that so much can be gained as the author appears to suppose, yet, if there is any advantage in the lead, it is probably in beginning to get rid of the waste steam before the commencement of the stroke, so that, when the piston commences its stroke, there is but little waste steam before it to resist its progress, the steam beginning to be let out of the cylinder before it has driven the piston to the end of the stroke. Now there is clearly this advantage in beginning to let out the waste steam before the end of the stroke, that, supposing the time occupied in getting rid of the whole of it to be the same as without any lead, the portion of the stroke traversed by the piston during this time is less, because its velocity is on an average less; besides which, the resistance of the waste steam during the first portion of the time, namely, at the end of the previous stroke is thereby avoided, though at the expense of a part of the useful effect ot the steam in the latter part of the stroke: indeed, by as much as the pressure of the waste steam at the beginning of the stroke has been diminished by the eduction port having been already some time open, by so much must its effective pressure have been reduced at the end of the previous stroke. We have also already mentioned the resistance of the steam let on to the front of the piston before the end of the stroke, which of itself nearly compensates the saving of part of the resistance of the waste steam at the beginning.

The preceding reasoning is only intended to prove that there is little or no reason, and certainly no necessity to give a lead to the slide in *locomotive* engines; for other descriptions of engine it is needless to say any thing, as no one would ever think of giving a lead in any but a locomotive engine. It might however be advantageous to give a lead to the eduction only, as by that means the saving of resistance at the beginning, would not be counteracted by the additional resistance of the steam admitted into the cylinder before the end of the stroke.

To return to the action of the steam in the cylinder. The whole effect produced during an indefinitely short period of time is equal to the pressure of the steam on the whole area of the piston multiplied by the distance travelled by the piston during that time, the pressure of the waste steam being considered as a part of the resistance, or total effect. This is true, although at some moments the resistance may appear less than the pressure of the steam, and at others infinitely greater; for the compensation is perfectly made by the momentum of the moving parts, which serve as reservoirs of power, absorbing, as it were, the excess at one time by receiving an increase of velocity, and giving it out again at another time, when the pressure of the steam is inferior to the resistance. But although the pressure of the waste steam is strictly a part of the resistance, yet we shall, in the following investigation, deduct its amount from the gross power of the steam, and consider the balance as the gross power of the engine, which will then be equal to the useful effect, *plus* the friction and other resistances *in the engine*. In our next paper we shall commence this investigation with the low pressure condensing engine, for which the calculation is the most simple, and then extend it to the other varieties of engine.

ARCHITECTURAL COMPETITION.

Sir,—The subject of Architectural Competition is one, which at this moment, should be more than usually interesting to members of the profession. I do not, therefore, hesitate to request your insertion of the following correspondence, which I think, it will be confessed, exposes as unsatisfactory a case as any of those recently so much commented upon.

In the early part of this year, a committee formed for building a new church at Cardiff, advertised for plans, offering premiums of 20*l*. and 10*l*. for the first and second best designs. In conjunction with my partner, Mr. Brandon, I submitted plans, with a specification and estimate. On the 11th June, we received the following letter:—

Cardiff Vicarage, 10th June, 1839.

Gentlemen,—The premium of 20*l*. offered for the best plan and design for a church in this town, having been awarded to you, I have great pleasure in forwarding you from the committee, an order for that amount on the London and Westminster Bank, of which I shall be obliged by your acknowledging the receipt.

I am, Gentlemen, your very obedient Servant,

T. Stacey, Hon. Sec.

In the course of two or three weeks after the receipt of that letter, we heard it rumoured that a Mr. Foster, of Bristol, was to be employed as *architect to this church*. Being at a loss to reconcile this statement with the announcement that our's was "*the best plan and design*," we wrote to say, that if their subscription fell short of the contemplated amount, we should be happy to submit sketches for a building on a reduced scale. On the 25th June, we received the following letter.

Cardiff, 24th June, 1839.

Gentlemen,—I fear I have been guilty of an omission in my last communication, that has occasioned you some misconception relative to the proceedings of the committee for building the new church here. Had it occurred to me, the most obvious mode of putting you in possession of their intentions, would have been to send you a copy of the resolutions adopted at the meeting at which the first premium was awarded you. And no better mode occurs to me now. I therefore beg to subjoin a copy of that resolution :—

"It was unanimously resolved, that the premium for the best plan be adjudged to Messrs. Wyatt and Brandon, and that the plan and design of Mr. Foster, of Bristol, be adopted by the committee for those of the new church," &c. &c.

Whilst, therefore, the committee adjudged your design to be the best *according to the advertisement*, they thought it preferable to adopt one furnished by a Mr. Foster, of Bristol. I feel now, that this should have formed part of my last letter, but at the moment I wrote, it seemed to me *that my silence would have been interpreted by you as indicative of the resolutions of the meeting.*

I remain, Gentlemen. your very obedient Servant,
T. Stacey, Hon. Sec.

Why Mr. Stacey should have imagined that from "*his silence*," we were to suppose the committee had resolved upon this unusual course, I am unable to guess. We, however, addressed him on the 25th as follows :—

Sir,—We have to acknowledge the favor of your letter of the 24th inst., and to state the fact of our having misconceived the purport of your former letter. When you announced that the committee had adjudged us the "*first premium for the best plan and design,*" it never for a moment occurred to us that the committee would take the unusual, and as we cannot help feeling the unjust course of employing another architect. Either our design was the best, *in accordance with your instructions*, or Mr. Foster's was. *If his accommodated* 2000 *persons, and was most applicable to your objects*, we think you did him an injustice in calling our's *the best*. If, on the contrary, our's was really *the best*, why not have done us the justice to believe that we were capable of altering that design, or producing another *quite applicable* to your wants? We cannot but think the resolution of the committee must have passed in forgetfulness of general custom and of the injurious effect *it must* have in competition generally. Surely, no architect of respectability would be found to expend time and money in designs where "the premium" was the only reward, and certainly not in a case where the amount of such premium is insufficient to cover the actual outlay in preparing those designs. It is only the superintendance of a building, which offers credit and remuneration to the architect proportionate to the thought and the anxiety expended on a meritorious design. * * * We beg to assure the committee, that these remarks are not written in a spirit of dictation, for to their decision we must, of course, bow; but it is not the less *our duty* to call attention to that which unexplained, implies either injustice on their side, or a stain on our professional character, for whilst it appears to the public that we have submitted "the best plan and design" you have received, they learn that *our* future services are declined, and an architect employed, *whose design was neither the first or second best.* We trust, therefore, that the committee will at least alter the wording of their resolution.

We have the honor to be, Sir,
Your obedient Servants,
Wyatt and Brandon.

The following letter acknowledges the receipt of our's of the 25th, and affords the satisfactory information that Mr. Foster is selected for the *highest premium* the committee could give, namely, their employment, because his "plan and design were not in accordance with the terms of the advertisement." This, certainly, is a curious specimen of justice, and will, no doubt, tend to impress upon the minds of future competitors, the *advantages* of strictly adhering to the instructions issued by committees.

Cardiff, June 27th, 1839.

Gentlemen,—I have had the honor to receive the favour of your letter of the 25th, and will not fail to lay it before the committee at their next meeting. But as it is not likely, from the progress of things, that I shall soon have an opportunity of doing so, I beg to state at once, and from myself, that the reason why Mr. Foster's plan and design were not awarded the first premium was, that they were not in accordance with the terms of the advertisement, and therefore it was, that your's were assigned the premium.

I have the honor to be, Gentlemen,
Your very obedient Servant,
T. Stacey.

One or two other letters passed, in continuation of this subject; that from Mr. Stacey, assuring us that the committee had not the least intention of "offering any mark of disrespect, or want of due consideration to the design of Messrs. Wyatt and Brandon, the merit of which they highly appreciate." On the 30th July we addressed Mr. Stacey.

Sir,—We have to acknowledge the receipt of your favor of the 29th inst., communicating the contents of a resolution passed by the Cardiff Church Committee. We regret the necessity of again troubling you upon this subject, but we must, for the last time, repeat our sense of the injustice done us; which, however unintentional on the part of the committee, is not the less apparent. It is only on the *understanding* that *all* the designs submitted shall be tested by the terms and conditions imposed by the advertisement, and that those designs which *do not comply with such instructions shall be rejected*, that architects compete. Unless all the competitors start from the same point, it is impossible that the race can be a fair one. Mr. Foster's plans, it seems, were sufficiently informal to disentitle him to the premium of 20*l.*, and yet these informalities are made to disappear, and he is awarded *the first premium, the superintendance of the building.* And the only premium, which in this case, was worthy struggling for. Surely this is not fair play! It was only on the faith, that the architect who received the first premium, would be employed to carry into execution any work the committee might erect, that you received plans at all. It is (unless specially excepted, as in the case of the competition for the Royal Exchange now going on,) the basis of all understanding between committees and competitors—once destroy this, and you put an end to competition. In the case of the Royal Exchange, the premiums offered are 300*l.*, 200*l.* and 100*l.*, with this clause, "That if the architect who receives the first premium should not be entrusted with the building, he shall receive an additional sum of 500*l.* if his designs are carried into execution. The committee having power to retain the drawings for which the premium is awarded." Now here there is no understanding, and the fact of their considering it necessary to make these conditions, implies that without them architects should not be invited to compete. Under the circumstances of the case, we have no desire to retain the premium *thus* awarded us, and are prepared to return it, upon being informed to whom it should be paid.

We have also to request you will give directions for our drawings being returned; under any circumstances, they are not the property of the committee, and as they are going to build on Mr. Foster's plan, our design can be of no service to them, unless for the purpose of adopting any arrangement or feature of merit they may be thought to possess; a proceeding which we are unable to suppose a committee of gentlemen would sanction.

We have the honor to be, Sir,
Your obedient Servants,
Wyatt and Brandon.

To this letter, on the 28th November, we received the following reply :—

Cardiff Vicarage, 27th November, 1839.

Gentlemen,—I beg to forward you the following copy of a resolution of the committee appointed for the erection of a new church at Cardiff, passed on Monday the 25th instant.

The secretary having laid before the meeting a letter from Messrs. Wyatt and Brandon, commenting again on the adjudication of the premium for the best plan, it was resolved :—

"That the secretary be directed to return Messrs. Wyatt and Brandon their plans as they desire, and to inform them that the amount of the first premium awarded them, which they decline to retain, may be paid into the London and Westminster Bank, to the credit of the treasurer of the Cardiff New Church Building Fund."

In pursuance of the foregoing resolutions, I forward your plans by this days' mail, carriage paid. I desire you should understand that the committee meeting of the 25th, was the first that has been held since the receipt of your letter of the 30th July, otherwise it would have been replied to earlier.

I have the honor to be, Gentlemen,
Your most obedient Servant,
T. Stacey, Hon. Sec.

Here closes the correspondence. We have received our designs, and the premium has been returned. Mr. B. Ferry, to whom the second premium was awarded, viewing the matter in the same light that we did, remonstrated by letter, against this act of the committee, and informs me, that the replies he received as to the grounds on which Mr. Foster is employed, were "equally unsatisfactory" with our own. It is always difficult in cases where one's own interests or feelings are concerned, to take an impartial and correct view. And possibly this case, which to any eye presents an *inconsistent*, if not an unjust appearance, may have occurred before, and may not be thought to call for the remonstrances we deemed it right to make. Its consideration, however, can do no harm to those who may hereafter engage in competitions, and if, by the course adopted we have tended in however slight a degree to assert the independence and correct feeling of our profession, the end we had in view will be fully realized.

I am, Sir,
Your obedient Servant,
Thomas Henry Wyatt.

75, Great Russell Street, January 1840.

REMARKS ON RAILWAYS,

WITH REFERENCE TO THE POWER, &c. TO BE EMPLOYED UPON THEM.

(Continued from page 6.*)*

Having in the last number of the journal disposed of railways unfavourable to locomotive engines, we will proceed to examine level railways, with reference to the power to be employed on them, as in the former case. I will take an example lest it be said I make the case suit the principle, instead of making the rule apply to the case.

The Sheffield and Rotherham Railway has been completed about eighteen months; it will elucidate my views as well as any other, and because I am better acquainted with it than those at a distance, I will therefore take it as our example. As truth is what I wish to elicit by these remarks, perhaps it will be the clearest way to say at the commencement what I intend to prove; by so doing your readers will be enabled to judge how the arguments which I bring forward bear on the case.

It is that in the example we have taken, and in any similar one, we can have a *cheaper, more efficient and better railway* by having endless ropes, and stationary engines, than by locomotives.

To prove this, it will be necessary to go into calculations; but to make them as short as possible, I will only give the results, reserving to myself the opportunity of giving them at full length, should any of your readers deny their correctness. First, as to "cost of the railway." It is said the Sheffield and Rotherham Railway has cost already £110,000, about £80,000 of which would go for constructing the railway, viz., embankments, excavations, &c., and for permanent rails. It will not, I think, be disputed that the embankments and excavations on this comparatively level country have been made at a cost of at least £33,000 more than they would have done had fixed engines been the moving power; and as some of the engines upon this railway weigh 16 tons, we may safely take off £7,000 from the first cost of the rails and chairs, making, with the sum first mentioned, £40,000 or the railway, would have cost £40,000 less than it has done had fixed engines been the power contemplated. The interest of this sum, at 5 per cent., is £2,000 per annum. So much for the cost of the railway.

We will now go to the second part of our subject, viz., "more efficient." An engine and tender will weigh about 20 tons; suppose we call the engine 50 horse power, we shall have, at 30 miles per hour, a power of $12\frac{1}{2} \times 50 = 625$ lbs., which will take, on a level railway, nearly 56 tons, 20 of which is taken up by the engine and tender, leaving 36 only conveyed by an engine of 50 horse power at 30 miles per hour.

To convey 36 tons by the stationary system, it will require a rope 3½ inches circumference; 2 miles of it would weigh about 4,600 lbs. Messrs. Walker and Rastric take the friction of the rope to be $\frac{1}{22}$ part of its weight; I see no reason to vary from their estimate; but as Messrs. Robert Stephenson and Joseph Locke, whose bias would be against stationary engines, take it as $\frac{1}{12}$ of the weight. I will, in deference to the opinion of these latter gentlemen, take it to be $\frac{1}{15}$, which is about half way between the one and the other; $\frac{1}{15}$ of 4,600 lbs, is 306 lbs. The friction of the train is 403 lbs., together 709 lbs. which divided by 12½, the power of a horse at 30 miles per hour = 56 horse power, or 6 horse power more than the locomotive. But the locomotive would have to get its steam up before working, and there would be fuel in the fire-box when it had arrived at the end of its journey; I shall take it working 5 minutes before and 5 minutes after, which will make, with the 15 minutes in performing the journey, 25 minutes, or what is about the same thing, 83 horse power for 15 minutes.

Though the stationary system requires an engine 56 horse power, yet, as the 72 trains per day, 36 tons at a time would only occupy, in the two miles worked by each engine 24 minutes per hour, it would only be needful to have them 36 horse power. The distance from Sheffield to Rotherham, 6 miles, is divided into 6 stages, requiring an engine at every other stage; but as it would be more convenient to have one at each end, it will require 4 engines. These 4 engines are employed the whole of the 12 hours, without any intermission, in pumping water out of one reservoir into another fixed 40 or 60 feet above it; the water in the upper reservoir is allowed to run over a water wheel as it is wanted to move the trains, which, as before stated, is about 24 minutes in every 60, by which the 36 horse power engine becomes increased to 90 horse power, or there will be as much water pumped in the 60 minutes by the 36 horse power engine as would supply a water wheel of 90 horse power, if there were no waste; but the loss from this cause, and from friction, will be 33 per cent., which will reduce the engine to 60 horse power, or 4 more than is required; it appears, then, we only require engine power of 144 horses. It is hardly likely that 3 trips per hour each way, for 12 hours, would be made by fewer than 6 locomotive engines kept ready all the time, which would be equal to 300 horse power than twice as much as the stationary, and certainly more than four times the expense in fuel, and by using coke instead of coals, and being high pressure instead of condensing engines.

We think the second part of our proposition "more official"—is clearly made out. There remains now the third, viz., "a better railway;" this will be more difficult to prove, it is such a comprehensive term; but we don't fear being able to do so.

If we can travel as fast, or faster, at a smaller expense, injure the rails less, be less liable to accidents, either to the machinery or rails, have no more stoppages from the machinery getting out of order, and have such stoppages as do occur, shorter, and sooner remedied. If we can insure all these at about half the annual expense in repairs, are we not justified in saying we could have a better railway, I will begin with "speed;" in wet weather, on the Sheffield and Rotherham Railway, it is the practice to put sand on the rails, where there happens to be a slight inclination, to make the wheels bite, and so much are the wheels in the habit of slipping on all railways, that Mr. William Vickers, a merchant in Sheffield, who has a good knowledge of mechanics, and is pretty well acquainted with the working of railways, has been induced to take out a patent for the plan of connecting all the wheels together by means of a belt or strap. If they slip they must lose speed, and injure the rails at the same time. With regard to the speed of the stationary plan, it depends upon the speed of the engine, and is only limited by the strength of the materials of which the rope, pulleys, engines, &c. are constructed; and were there no such thing as resistance of the atmosphere there would be hardly any limit to it. Then comes the relative expense at which this can be done. If we increase the speed of the locomotive, the engine and tender will form a much larger proportion of its load than at present, because it will require a greater quantity of fuel and water on account of the increased power of the engine. The engine would have to be made stronger and heavier to take the same load. The rails, chairs, and every thing connected with them would cost more in repairs, because of the increased speed and weight of the engine, and the engine itself would be sooner worn out. While, on the stationary plan, the only difference would be an increase in the power of the engines, greater strength, of rope and pulleys, and an additional wear in the two latter, the rails, chairs, &c. remaining the same.

I find I am getting unnecessarily into the *minutiæ* of the subject. All these things are important, no doubt, but will be wearisome to your readers to go through. I will therefore confine myself to the comparative safety and annual expense of the two systems. The greater the weight in motion, the less it will be influenced or impeded by obstructions, and this will render it more liable to get off the rails at the curves, and make it more difficult to stop. It appears that locomotive trains will always have 20 tons more weight, as already stated, than the stationary system, the conclusion is obvious. The large wheels of the locomotive engine would have a tendency to run off the rails, the ropes of the stationary plan would tend to keep the carriages on. The engine and train being independent of any other, would be in danger of coming in contact with other trains, unless those trains were at a considerable distance, and every collision without great care would throw carriages in the train of one or both of them off the rails, and occasion great delay to say the least of it. The stationary plan might have a hundred trains, a hundred yards of each other, and they would never approach nearer, this needs no comment. In comparing the annual expense of the two, it will not be necessary to ascertain the expence of each, but only where they differ, to estimate the amount of each. The locomotive engines cost about £1,300 each, and if they are fully worked will cost £300 per annum in repairs, or if half-worked £150. (Let Demetrius and the Craftsmen deny this if they can.) We will take them to be half-worked, there would then require 5 engines and one spare engine, making 6 engines in constant work, so that the cost per annum would be $6 \times 150 =$ £900 for repairs. The engines will last not more than nine or ten years. We will take them at 13 per cent. on 6 engines, which will be £1,014; the fuel we will estimate at 1¼ per ton per mile, including waste at each end, we shall have to reckon 50 tons moved in this case and not 36, but as the coke and water is consuming, I have reckoned 50 tons, 72 times 6 miles for 312 days, which amounts to 6,739,200 tons conveyed one mile, 1¼ lb. per ton on this will be 3,760 tons of coke, which is 14*s.* per ton, the amount of this will be per annum £2,632. I shall take the enginemen, firemen, &c., to be the same in both systems, therefore need not take them into account; the expence, then, of the locomotive system from these three items will be £4,546 yearly.

The stationary plan has 4 engines of 36 horse power each, on the same principle as those in Cornwall, viz., work with 50 lbs. steam, and cut off the steam at one-fifth of the stroke, these engines consume 2½ lbs. per hour for horse-power; 12 hours per day, 312 days, it will give per annum about 602 tons at 5*s.* per ton, or £150 10*s.*

The ropes will not require renewing oftener than once in twelve months because there are not jerks or stoppages at the stations, the cost of this, after deducting the value of the old, will be £525. The four engines, engine-houses, and machinery, would cost £8,000, at 6½ per cent. would be £520. The annual repairs to boilers, engines, and machinery, taken as by Messrs. Walker and Rastric, including hemp, oil, and tallow, at 14*s.* 8*d.* per horse power, will be £106 8*s.* The interest, wear and tear of pulleys would be £300, oil to pulleys, and men to grease them, £144, all which sums amount to £1,745 18*s.*

The whole yearly expense of the stationary system amounts to £1,745 18*s.* The expence of the locomotive system, £4,546, making a difference in favour of the stationary of £2,800 2*s.*, which sum, added to the £2,000 per annum saved in the first cost of the railway, amounts to £4,800 2*s.* If the saving of £4,800 per annum does not speak to the pockets of the shareholders, nothing I can say will do it. If gentlemen of fortune wish to have railways, let them have locomotive engines upon them by all means to show to their wives and daughters, but if men of sense and men of business wish to have their shilling's worth for a shilling, let them search and see if these things are so.

DIOGENES.

Sheffield.

(To be concluded.)

ENCROACHMENTS AND RECESSIONS OF THE SEA.

It appears that the tendency of "*the sea to preserve its parallel,*" has been pointed out in No. 27 of the Journal as the origin of the encroachment and recession of the sea, and that the action of the influx of water is increased in bays in proportion as the projecting point to the westward is greater, while it is assumed that the filling up of bays and cutting of headlands are equal. The meeting of the tides from the Northern and Southern Channels to the eastward of Hastings, renders a reference to the geological facts to the westward most advisable.

The beds of sand, sandy rock, and clay, denominated the Wealden formation, are supposed to dip from Hastings to Beachy Head, and to disappear under the chalk at that point. The outcrop of the highest sand-rock bed is visible from thence to the Sea Houses, East Bourn, but in the interior, the height of the beds above the sea level seems in some proportion to their hardness. Pevensey Castle is placed towards the end of one of these low ridges, so formed, and Pevensey Level consists, judging from the drains, of the outcrop of the clay beds, and not of the detritus of the chalk cliffs to the westward. Romney Marsh is sometimes considered as a more modern deposit of silt; its position, in some geological maps, is in front of that part of the Hastings sand, dipping easterly from the anticlinal line near Hastings; it is said to have successive ranges of beach banks, of a form nearly corresponding with the present coast line. If these opinions are correct, it differs essentially in its formation from Pevensey levels, where, I believe, a small extent only of beach, covered with grass, exists at the eastern end. The accumulation of beach at Langney point, perhaps amounting to 1000 acres, is at a lower level, and is almost as bare of grass as the shore on which the sea now beats, while its character is similar in all points to the mass of beach at Dungeness.

It has been most distinctly proved, that an ancient raised beach exists around the coast of Cornwall and Devon elevated in different sites from 5 to 30 feet or more, and covered with a Grauwacke detritus termed alluvial by Dr. Buckland.

At Brighton there seems an equally distinct trace of an equivalent raised beach covered by a diluvial chalk detritus, as due to a similar cause in different sites. Perhaps the grass-covered beach banks of Romney Marsh and Pevensey Level, are due to the same geological epoch, and the accumulations of beach at Langney point and Dungeness belong to the present era.

Previous to the admission of any arguments derived from the beach at Hastings Bridge, it must be proved to be a portion of the present sea beach, as its site and height above the sea would suggest the idea of its forming a part of a raised beach of a former geological period.

In reference to the question of equal cutting and filling, it has been shown by geologists, that the waves are the cutting agents of the sea in the destruction of cliffs, and that the tides or currents sweep the finer particles into deeper water, and leave the harder part on the shore, which are rounded into beach; the whole coast, whether high or low, is fringed with a variable quantity of beach, which is driven along the coast in proportion to the diagonal blow of the waves, and consequently the mass is in motion eastward, as due to the mean excess of the westerly over the easterly waves.

The effect of groins is easily seen; the beach is collected on the weather side, while the lee side becomes bare; hence equal waves have a greater cutting effect on the softer materials of the exposed shore or cliff, and less on the side protected by the accumulation of beach, and in their construction, the principle to be regarded is the retardation of the exact quantity of beach requisite for the protection of each spot, allowing its regular passage either way; the groin referred to at Hastings is probably either too large, or too high at the outer end—the result is inevitable, the shore on each side will be overprotected, or overbared, alternately, according to the direction of the wind.

My object has been rather to question the data assumed than to attempt to elucidate this subject by a reference to the numerous elements essential for that purpose, partly with a hope of inducing civil engineers, to measure and record clearly the geological facts which may happen to come under their notice in the course of their professional labours.

E.

ON THE COMPARATIVE POWER OF STEAM ENGINES.

SIR—Though I have read with great pleasure the communication of Mr. Armstrong on the comparative effects of the Cornish and Lancashire system of working steam engines, yet I must object to the accuracy of the estimate of the gross horse power of the East London Water-works engine, and I trust the following observations will induce others to take into consideration the propriety of confining the term Duty to the distinct and definite meaning in which it has been employed in a large mining district for a longer period, than the existence of factory steam engines. His paper is entitled, "On the Comparative Effects," the table is headed "Comparative Duty;" the pounds raised one foot high per minute ÷ 33,000 are termed "Gross Horse Power," while this same quantity 194 is termed "Net Effective Power," previous to the deduction of one-third for the resistances of the shafting; yet each is actually derived from the same elements, viz., the average steam pressure taken by the indicator in the Lancashire engine, and the supposed gross load + an allowance for "friction of the engine itself," in the Cornish engine × in each case by the space in feet per minute for gross horse power. The gross pressure of steam whether observed or calculated, is equally capable of being referred to the variable time of the consumption of a bushel of coal (94 pounds), but then such a word as Efficiency would be useful in distinguishing it from Duty. See Phil. Trans., 1827.

Duty as introduced by Watt, and retained in Cornwall, is founded on different elements, viz. the nett work performed clear of pitwork or shafting resistances, × by the space of motion per bushel of coal, it is always calculated, but if the water was measured or weighed, it might be called active duty: the usual mode of obtaining the load in the shaft is by squaring the pump diameter in inches, × by the lift in fathoms, × by 2·0454 pounds, the weight of a cylinder of water one fathom in length and one inch in diameter: the omission, however, of the two last decimals, only affects the three last figures of the duty in millions.

Duty and gross power are hence the extremes, while gross power *minus* engine resistances, and duty *plus* pitwork or machinery resistances become respectively nett power, = engineer's horse power, and gross work performed, and these on a statical view are equal to each other—the word effect will be found a convenient term to distinguish gross work done from duty, It has always been necessary to ascertain whether the beam leverage is equal, if not so, due allowances must be made for the differences; it will be also convenient to use the word pressure as equivalent to force, and force × space as power, while gross and nett load become respectively effect and duty.

In the arrangement of the East London Water-works engine, a weight of 29 tons is lifted at the outer end of the beam during the in-door stroke, but not without some packing friction, as well as a column of water on the lower valve of a diameter equal to that of the plunger pole—together, these form the gross load on the in-door or acting stroke. During the out-door stroke the weight returns and lifts the water above the lower valve, overcomes friction, &c. &c. As friction increases in bad pitwork, at least, as fast as the deficient water delivery—while the reverse takes place in good, the calculated duty of pumping engines probably, bears a closer approximation to the whole work done, or effect, than might be expected.

In all cases I am inclined to think the pitwork resistances exceed the decrease due to deficient water delivery. There are no data for duty calculation, except by valueless approximations. I shall however submit to public opinion the following estimate of the gross power of this engine, in comparison with that derived from the "Average Steam Pressure, taken by indicator," in the Lancashire factory engine. I conceive the allowance of half a pound per circular inch for the "friction of the engine itself," a quantity scarcely sufficient to overcome the steam or vapour pressure due to the temperature of the water in the condenser.

Weight in-doors 29 ton - - = 64,960 lbs
Stuffing box friction, say - - = 501
41^2 inches × 1 fathoms × by 2·0454 lbs = 3,439

Gross load in lbs. - - - = 68,900 load for effect.
Quarter of effect load = 1-5th gross power - - - = 17,224 engine's resistances,

= 86,124 lbs.

. Gross steam pressure on the shaft.

In a recent communication by Mr. Wicksteed, relative to the success of the Harvey's and West's patent double beat valve, the pump stroke is stated to be nine feet, and consequently 90 feet of motion at 10 strokes per minute. Taking the gross pressure in the shaft at 86,124 lbs. × 90 feet, = 7,751,160 lbs. one foot high, we have $\frac{7,751,160}{33,000} = 235$ gross horse power.

In consequence however of the prevalence of the method among practical engineers of deducting the resistances due to vacuum, imperfections from the observed average indicator pressure, and calling the result average steam pressure (a quantity I should feel disposed to term a worthless mean between gross and nett power of no practical value, and absolutely injurious in tending to mislead in estimates of pounds of water used in the cylinder), it would not be fair to contrast that which is proposed to represent the gross power of a good Cornish engine, until it has been ascertained whether the observed or calculated gross steam power in the Lancashire factory engine has been given.

The error will be in its favour if an allowance is added of $\frac{1}{12}$, perhaps, for this practise, while the engine's resistance, ought perhaps to be taken higher than one-fifth of the gross power to allow for the greater friction of smaller cylinders working at a high power, if required; it appears to me that the one-third allowance should be deducted from the nett power thus obtained, for a duty estimate, giving 20 millions as a rough approximation.

34,754,432
One-twelfth - - - - = 2,896,202

37,650,634
One-fifth engine resistance - = 7,530,126

30,120,508
One-third shaft-work - - - = 10,040,169

Duty - - - - - - = 20,080,339

My object is to recommend the simple classification here used, subject to any corrections of engine or pitwork resistances, conceiving if attention be called to this subject, it will soon lead to the adoption of correct methods, which will facilitate the connection of theoretical and practical views of steam engines.

I am, Sir,
Your obedient servant,
JOHN S. ENYS.

January, 1840.

Discovery of a Cavern.—As the workmen were employed in blasting the rocks near the foundation of one of the Clifton suspension bridge piers, a day or two since, they discovered a small opening. On its being examined, it was found to lead to a small cavern extending fifty-seven feet below the surface of the ground, nearly in a perpendicular direction. The exploration was made by Dr. Fairbrother, with the assistance of one of the workmen. There were several chambers at intervals, but the descent is difficult, and can only be made with the assistance of ropes. The air is tolerably pure, so that the candle burnt freely during the whole of the time (nearly two hours). At the bottom, the air was found to be excessively hot, so that the perspiration flowed freely. In other respects the cavity presented nothing remarkable, beyond the ordinary appearance of fissures formed by the raising of the strata of lime-stones by some extraordinary convulsions of nature.

THE CORNISH ENGINE,

AT THE EAST LONDON WATER WORKS.

As the above engine is likely to become an object of considerable interest to engineers, we determined upon paying a visit to the Water Works at Old Ford, for the purpose of obtaining correct information as to her dimension and mode of working. On our arrival at the works, Mr. Wicksteed, the engineer to the Company, immediately granted us permission to inspect the engine, and kindly offered to afford any information we might require, and for this purpose, accompanied us on our view, and readily answered every enquiry, explaining at the same time, the general working of the engine. Before proceeding to the details, we must offer our congratulations to the directors of the Company, on the successful performance of the engine, and we feel happy to find that the very large pecuniary saving in fuel annually, by the adoption of the Cornish engine, will amply repay them for the spirited manner in which they came forward to support their engineer against the almost unanimous opinions of the London engineers, who generally pronounced the boasted performances of the engines in Cornwall to be preposterous. Through the kindness of Mr. Wicksteed, we are now enabled to lay before our readers practical data of the economic working of the engine at the East London Water, Works, which we believe, is the first and only Cornish engine that has been yet erected in the metropolis.

The engine was originally intended for a Cornish mine, known by the name of the "East Cornwall," it was designed by Mr. West, a member of the Institution of Civil Engineers; it is upon the same principle as the one designed by the same gentleman, erected at the Fowey Consols Mines, which has for several years past done more duty than any engine in or out of the county of Cornwall, and manufactured by Messrs. Harvey and Co. of Hayle; it was purchased by the East London Water Works Company in 1837, and removed to London and fixed in its present situation by Messrs. Harvey and West, who have, by the superiority of the working of this engine, and the faithful execution of their contract, given most unqualified satisfaction both to the directors and to Mr. Wicksteed.

Dimensions of the Engine.—The diameter of the steam cylinder is 80¼ inches, and length of stroke, 10 feet 3 inches; the steam is generated in the boilers, under a pressure of 35 lb. on the square inch above that of the atmosphere, and cut off when the piston has performed about one-third of its stroke, it then expands during the remaining two-thirds, and in the suceeeding stroke is condensed to form a vacuum on the opposite of the piston, to which it passes through the equilibrium valve in the return stroke, the engine being *single acting.*

By the use of the apparatus called a *cataract*, the engine can be made to work from one (or less) to ten strokes per minute, as may be required. According to the calculations of Mr. Armstrong in our last Journal, the power of the engine is equivalent to 206½ horses, and by the statement of Mr. Enys in the present number, 235 *gross* horse power. Mr. Wicksteed, however, informs us that the actual weight lifted is 66,443 lbs. an average height of 9 feet each stroke, which is equal to 18·12 horses' power when the engine works one stroke per minute, or, 181·2 horses' power at 10 strokes per minute, a velocity which Mr. Wicksteed deems the greatest *this* engine should be worked at.

Dimensions of the Pump.—The diameter is 41 inches, length of stroke 9 feet 4 inches, quantity of water lifted at every stroke 82·5 cubic feet, or about 14¼ imperial barrels, which is a week's average supply for a house. The plunger-pole of the pump, is loaded with about 29 tons over and above the other end of the beam, and this is the weight the engine has actually to lift at every stroke.

We were very much pleased with the quiet action of Messrs. Harvey and West's patent valve, there we felt any perceptible vibration, although we stood close to the pump; we have given the drawings and specification of the valve in another part of the Journal.

The steam is generated in four cylindrical boilers, 27 feet 8 inches long and 6 feet 5 inches diameter, constructed on Mr. West's Cornish plan; the tops of the 4 boilers are covered over with fine ashes, to prevent the loss of heat by radiation. The area of the boilers exposed to the action of the flame and heated air, is very great; and the furnaces are constructed with a large surface of fire grate, in proportion to the coals consumed, for the purpose of adopting the principle of slow combustion, which is here carried out to its fullest extent, so much so, that when the furnace doors are opened, the smoke at times comes out of the furnace doors into the stoke-hole.

We must also state that the steam cylinder is surrounded with a jacket, which is filled with steam from the boilers, and there is another jacket, or casing of boards, the interval being filled in with ashes, 17 to 18 inches in thickness; all the steam-pipes are also well cased with patent felt, or ashes in boxes.

The following particulars will show the working of the engine for 18 weeks, during which period it worked 2,923¼ hours, and made 1,012,353 strokes, at the average rate of 5·77 per minute, it raising 13,982,942 barrels of water, (of 360 lbs. each barrel,) 112 feet 6 inches high, with the consumption of 361 tons, 15 cwt., 1 qr., (= 810,348 lbs.) of coal of inferior quality, being the refuse or screenings of Newcastle coal, which has passed through a screen of ¾-inch thick mesh. By adopting the method of slow combustion, they are thus enabled to use the screenings, which costs only 17*s*. per ton delivered, whereas the superior coal required for rapid combustion, would cost 23*s*. or more.

During the same period, a condensing engine of the ordinary construction made by Boulton and Watt, with a cylinder 80 inches diameter and stroke 8 feet, with a pump 27⅛ inches diameter and stroke 8 feet, worked 1,345½ hours made 1,152,424 strokes, raised 5,416,385 barrels of water, and consumed 275 tons, 17 cwt., 3 qrs., (= 617,988 lbs.) of coal as above.

The Cornish engine works constantly under the same pressure, while the pressure in the Boulton and Watt engine is constantly varying, never exceeding the former, but on the average, less.

The Cornish engine worked night and day during the above period, with occasional stoppages, while the ordinary engine worked by day only; but the work of two other engines, on Boulton and Watt's construction, which worked night and day during the corresponding weeks of the previous year, was as follows:—They worked for 2,938¼ hours, and made 2,068,430½ strokes each; they raised together 9,309,362 barrels of water, and consumed 568 tons, 1 cwt., (= 1,272,432 lbs.) of *best* coal.

Before the Cornish engine was erected, the East London Water Works Company had, in addition to the water-wheels at their Stratford and Lea Bridge Stations, four steam engines, besides an extra one, which worked during the summer months:—viz. two engines of 30-horses power each, which worked 24 hours; and two of about 95 horses power, which worked, upon an average, 12 hours *per diem*, the extra one was of 70 horses power, and worked occasionally in the summer. The consumption of coal amounted to 3,426 tons per annum, which was about £3,700., while the present engines, viz. one Cornish engine, working 24 hours per day, and averaging six strokes per minute, and one large Boulton and Vatt engine, working 60 hours per week, calculating from the 18 weeks' consumption for both engines, the annual consumption will be 1,941 tons, which cost 17*s*. per ton, or £1,649. 17*s*., thus effecting a saving of £2,050. per annum.

If 66,443 lbs. be taken as the actual weight lifted at each stroke, (independent of friction and resistance of the engine,) and multiplied by 9 feet, the average length of the stroke of the pump, it will give 597,987 lbs., lifted one foot high at every stroke, if this quantity be multiplied by the number of strokes, the engine performed during the eighteen months, and divided by the consumption of the fuel during that period, it will give: $\left(\frac{597,987 \times 1,012,353}{810,348}\right)$ 747,054 lbs., as the *useful effect*, raised one foot high by 1 lb. of coal or 70,223,076 lbs., by one Cornish bushel of 94 lbs. of coal. It should be observed, that the amount of coals herein given, includes the coals used to keep up the steam whenever the engine stopped during the period mentioned.

In order to secure themselves against receiving inferior coal, the Directors have entered into a very peculiar contract (which we would recommend to the notice of other companies) with their coal merchant to supply them with coal of the same quality throughout the year, he guaranteeing that above 73 million pounds of water shall be raised one foot high by the consumption of 94 lbs. of coal, which is equivalent to about 2½ lbs. per horse power per hour; or in case of the average duty of the coals not amounting to so much, a proportionate reduction is to be made in the amount to be paid to him.

We trust the foregoing statement will prove interesting to the readers of our Journal. We should have been pleased if we could have presented engravings of this engine to our readers, but we do not so much regret the want of them at present, as we should if Mr. Wicksteed had not informed us that he intends to present complete drawings of the engine and boilers to the Institution of Civil Engineers, with a report, as soon as he has obtained some farther facts which he deems of the utmost importance, namely, the actual quantity of water evaporated by a given weight of coals, the quantity of water passing through the cylinder in the shape of steam to produce the effects stated, and in addition also, the same facts as regards a Boulton and Watt engine, that a fair comparison may be made between the two systems of expansion and non-expansion, and also to prove how much is due to the superiority of the boilers (if any), and how much to the mode of *using* the steam when generated.

The system adopted in Cornwall of reporting to the public every month the duty of the engines, has, we have little doubt, led, by exciting emulation, to the perfecting of the expansion engine, and if in other parts of England the same system were adopted, there is no doubt the public would benefit, as well as those manufacturers whose desire it is to make the best engine, and we therefore offer to those interested in the subject to publish in our Journal the reports forwarded to us. We have little doubt of having a monthly report of *the* Cornish engine, and we should like to have reports of others to compare with it.

MEMOIR OF DAVIES GILBERT, ESQ.

(From the West Briton.)

DAVIES GILBERT, Esq., D.C.L., late President of the Royal Society, was Hon. F.R.S.E., F.A.S., F.L.S., F.G.S., F.R.A.S., President of the Royal Geological Society of Cornwall, Hon. Member of most of the provincial societies in the Kingdom, and of many on the Continent; he was also many years Member of Parliament for Bodmin, our county town, and was truly known as the Father of British Science. He was the only son of the Rev. Edward Giddy, of St. Erth, the representative of the respectable family of Giddy, of Nanteavallan, by Catherine, only daughter and heiress of Henry Davies, Esq., of Tredrea, only survivor of the ancient house of Davies, through whom he was connected with the noble family of Sandys, and that of Noyel of which the well-known Attorney-General was a member.

When a child, his precocious talents were the theme of the extensive circle with which his father, as chairman of Quarter Sessions, associated. His preliminary education was conducted at home; and at a very early age he contracted an intimacy, which continued until death, with the Rev. Malachy Hitchens, vicar of St. Hilary, a gentleman of high and well-deserved celebrity as a mathematician and astronomer, and as editor of the "Nautical Almanac." This acquaintance, without doubt, materially added in determining his mind to mathematical pursuits, in which he was afterwards so greatly distinguished. His academic education was received at Pembroke College, Oxford, to the funds of which he has been a liberal donor.

The introduction of Mr. Watt's celebrated improvement in the steam-engine into the Cornish mines, and the disputes between that great mechanical philosopher and the late Mr. Jonathan Hornblower, of Penryn, as to the economy and mode of applying the principle of working steam expansively, and which has since been carried to greater extent, and with a more remarkable economy of fuel in this county than any where else, early attracted Mr. Davies Giddy's attention; and the various subjects embraced in its perfect development formed a noble field for the employment of his rare mathematical attainments, The expansive action was employed by Mr. Watt in a single cylinder, but Mr. Hornblower used two. It was, however, far more readily made out in theory than it was acknowledged in practice, that by the use of one cylinder only the same mechanical advantage is obtained, avoiding the additional friction which a second cylinder would entail. The plan of Mr. Hornblower was, after a silence of several years, revived by Mr. Woolf: but it seems by general consent and experience, and by universal practice, to be now admitted that Mr. Watt's is the preferable mode.

Mr. Davies Giddy was solicited by the county at large to take an active part in the determination of the duty performed by Mr. Watt's engines—a task for which his genius and inclination peculiarly fitted him; and in conjunction with the late Captain William Jenkin, of Treworgie, he made a survey of all the steam-engines then working in Cornwall.

An indifference to the labours of authorship, provided the results of his inquiries were available to the public without appearing in print, prevented the investigations of these most important subjects from seeing the light in an authentic form until lately; the first of them appears in the Philosophical Transactions of the Royal Society in 1827—the second still more recently.

One of the most laborious and practically useful works which has distinguished that rich storehouse of intellectual wealth, the Philosophical Transactions of the Royal Society, is a paper by Mr. Gilbert, "On the Properties of the Catenary Curve." This fine example of mathematical inquiry was published whilst the celebrated engineer Telford was preparing his materials for the construction of that stupendous national work, the Menai bridge; and it affords one of the finest tributes on record to the labours of the philosopher in his closet, that after the appearance of Mr. Gilbert's memoir, the engineer caused the suspension chains which had been prepared and completed to be again taken in hand and lengthened by about thirty-six feet. The manner in which this magnificent structure has stood, proves that the principles on which it was constructed are perfectly accurate, but that its weight is insufficient to stand the storms to which it is exposed, without a vibratory motion, which is injurious to its stability.

One of the most remarkable incidents in Mr. Gilbert's life was his discovering, patronising, and encouraging the early struggles of Davy (afterwards Sir Humphry), whose introduction to public life, and to other friends, who brought him, his genius, and ability into notice, was due to his active and unvarying friendship. This is, however, matter of history, and most of our readers are acquainted with it.

In 1828 Mr. Gilbert was, by acclamation, called to that pre-eminently honourable station, the chair of the Royal Society, to which his profound learning and scientific researches, no less than his distinguished personal fitness, recommended him beyond every other person as the proper successor of Davy in the chair of Newton. This conspicuous place, at the head of British, and we may say European, science, Mr. Gilbert held for about seven years, with the highest honour to himself, and the greatest utility to that learned body. It is a case without parallel, and one of which, as Cornishmen, we are justly proud, that we have furnished two succeeding Presidents of the Royal Society. During his Presidency, Mr. Gilbert was a liberal donor to the society's funds, and he extended a large and an enlightened patronage to every object worthy of the illustrious body over which he presided. He resigned the chair in favour of his Royal Highness the Duke of Sussex, who is now succeeded by the courteous and learned Marquis of Northampton.

In his native county, to which he has ever clung with most tenacious affection, in 1814, Mr. Gilbert founded the Royal Geological Society of Cornwall, (with a single exception) the oldest provincial philosophical society in England, and continued to preside over it until his decease; conferring on it an importance which it would not have otherwise attained, and extending its utility where, without him, it would have been unknown. To the other philosophical, literary, and charitable institutions of Cornwall, he was equally a liberal and enlightened patron.

The last literary labour of Mr. Gilbert's long, honourable, and useful life, was editing the "Parochial History of Cornwall," originally commenced by Mr. Hals, and continued by Mr. Tonkin. This work appeared but a year or two since, with copious addenda by the editor, and geological notes by Dr. Boase. It contains a vast mass of curious and valuable antiquarian research, and rich disquisitions on many subjects of the highest local interest. Its effect has, however, been impaired by typographical inaccuracies, which the printer's carelessness has overlooked.

The rare talents, abilities, and application of Mr. Davies Giddy, at an early period of his life, recommended him to the acquaintance of the leading scientific men of the age, and the principal inhabitants of the county; among these was the late Lord De Dunstanville, a nobleman as much distinguished by his discrimination as by his large and munificent liberality. Through his lordship's instrumentality, Mr. Giddy was returned to Parliament for the borough of Bodmin, in 1807, after having sat as member for Helston; and the distinction thus conferred on him through, what we may not improperly term, extraneous means, was continued from an honourable appreciation of his own ability and worth, until the passing of the Reform Bill, in 1832, when his advanced age and increasing infirmities rendered him desirous of avoiding the turmoil of public life, and of retiring into the peace and tranquillity of his domestic circle.

Whilst in Parliament, there were few members more regular and assiduous in their attendance, than Mr. Gilbert; he generally, though not uniformly, supported the Conservative side of politics, but he seldom spoke, and was by no means an active partisan. His great learning and habits of business, recommended him to all parties; and he acted as chairman of a committee on the financial system, in the critical and difficult period when Lord Castlereagh was the ministerial leader in the Commons. The rectification of the national standards of linear dimensions and capacities, which was made a few years since, was undertaken on his motion for an address to the Crown on the subject. The bounty on the export of pilchards was long continued through his active interposition; and, indeed, every subject which in any way affected the interests of his native county, when it came before Parliament, ever found him at his post, an active, ready, and indefatigable advocate of her interests.

We have now seen him an illustrious philosopher, a learned historian, and an enlightened legislator; but the most distinguishing (and if we may use the language without charge of affectation), the most endearing character we have yet to mention, for it would be vain to attempt to describe it—his conversation; it was not brilliant—it was something infinitely beyond and better than mere display; it was a continued stream of the most profound learning and most exalted philosophy, adapted with exquisite taste to the capacity of his auditory, and enlivened with anecdotes to which the most listless could not but listen and learn. His manners were most unaffected, child-like, gentle, and natural. As a friend, he was kind, considerate, forbearing, patient, and generous; and when the grave was closed over him, not one man, woman or child, who was honoured with his acquaintance, but will feel that he has a friend less in the world; enemies, he cannot have left a single one. A Cornishman he was in every good sense of the word; the mention of a Cornish custom, of a provincialism familiar in his youth, would make the aged man young again; the scenes of his early years, tales of times long gone, were poured forth in delightful glowing language, the more touching from its hearty, earnest, unaffected, and simple elegance.

Within a few years of 1810, Mr. Davies Giddy was married to Mary, only child and heiress of — Gilbert, Esq., of Eastbourne, and took the name of Gilbert, instead of his patronymic of Giddy. This alliance brought a considerable accession of fortune to his already considerable paternal inheritance. By this lady, who survives him, he has had several children, but four only are now alive:—a son, John Davies Gilbert, Esq., a daughter, married to John S. Enys, Esq., of Enys, in this county, and two other daughters yet unmarried. Mr. Gilbert's age was, we believe, about seventy-four, and his long, honourable, and honoured life, crowned with peace, riches, and distinction, was in the bosom of his family.

"QUOT NOTOS, TOT HABUIT AMICOS."

WOODEN PAVEMENT.

Extract from Leitch Ritchie's "Glance at Russia in 1835."

The wooden pavement is, I believe, peculiar to St. Petersburg, and merits a description. It consists of small hexagons sawed from a piece of resinous wood, and laid into a bed of crushed stones and sand. These are fastened laterally into each other with wooden pegs; and when the whole forms a plane surface, the interstices are filled with fine sand, and then boiling pitch is poured over all. This pitch, from the porous nature of the wood, is speedily absorbed; and on a quantity of sand being strewed above it, the operation is complete, and a pavement constructed which is found to be extremely durable, and which seems to me to suffer much less injury from the frost than the stone causeway. The honor of the invention is due to Mr. Gourief, and I have no doubt he will ultimately see it adopted in most of the great towns towards the north. It is the custom of the peasantry to cut down the trees at some distance from the root, and thus a great deal of wood will be turned to a useful purpose, which would otherwise only encumber the ground. Every peasant, besides, by means of his axe alone, is able to construct such a pavement; and in Russia, hands are both plenty and cheap.

THE NEW ROYAL EXCHANGE.

In the Court of Common Council, on the 23rd ult., Mr. R. L. Jones brought up the report of the Royal Exchange Committee, which was as follows:—

"To the Right Hon. the Lord Mayor, Aldermen, and Commons
of the city of London, in Common Council assembled.

"We whose names are hereunto subscribed of your committee in relation to the Royal Exchange and Gresham trusts, to whom on the 6th day of August, 1831, it was referred to carry into execution the Act of Parliament for improving the site of the Royal Exchange, in the city of London, and the avenues adjoining thereto, and to report our proceedings from time to time, do certify that we immediately proceeded to carry the provisions of the said act into execution, and directed several notices to be given to the several parties interested for the purchasing of their property required for the site of the new Exchange, and, having received the claims of the respective parties, we duly considered the same, and have great pleasure in being able to report that the whole of such claims, with two exceptions only, have been adjusted; and, for the further information of this Hon. Court, we have caused a statement to be hereunto annexed, setting forth the sums claimed, and the amounts paid or agreed to be paid, for the purchase of the several premises, including the loss and damage incurred by removal, together with the manner in which each claim was settled; all which we submit to the judgment of this Hon. Court. Dated this 23rd day of January, 1840.

"Richard L. Jones.	Edward Hickson.
B. Stebbing.	Henry J. Elmes.
W. Richardson.	Thomas Corney.
R. Obbard.	Thomas Burton.
James Frisby.	William Croucher."

The following is the statement alluded to:

Buildings purchased for the new Royal Exchange and avenues. Estimate 150,000*l*., for which there were 56 claims.

42 cases claimed .	69,263	—Settled by committee at .	38,852
8 ditto for freeholds	107,981	—Referred to surveyors, and settled at . . .	94,136
4 cases claimed .	37,065	—Settled by verdicts at . .	12,284
2 ditto not settled .	5,508		
	£219,817		£145,272

UNION WORKHOUSES.

Sir—On my road from Woolwich to London, the other day, I was much struck with the extensive appearance of the long-talked-of new workhouse for this union, which was to be the *"largest and best house"* under the commission. I walked over the whole establishment, and certainly it is the largest and best built house I have seen under the Poor Law Commissioners—the main building being upwards of 420 feet in length, by about 45 feet in depth—in height three floors (with basement under about half), and the ground floor well kept up, standing in an enclosed square acre (of lower buildings and work-sheds) about, 500 feet × 400 feet, with an old looking building in front (north), for board-room and offices; large range of buildings at back (south), for hospital, infirmary, fever wards, &c.; and work-sheds, wash-house, laundry, &c., at ends; upon the whole, presenting rather an imposing appearance—also an improved one—in comparison with the beggarly looking things erected by the Union generally. Mr. Browne, of Greenwich, is the architect, as in all the other houses (or some parties for him) fretted away the interior of this otherwise noble establishment with a great number of little, low, narrow rooms, called wards, which, were it not for a gallery on each floor, running the whole length of the building (near 420 feet), would be exceedingly inconvenient and unhealthy too—notwithstanding the great care that has been bestowed in the arrangement of the ventilation, the supply of water, and the drainage, to the whole establishment, which appears to me to have been very carefully studied and well executed—as well as the water-closets and other internal arrangements generally. Upon the suggestion and under the able superintendance of Mr. Leake, the Guardian Clerk of the Works, unto whom—one of the Guardians of the Board informed me—they were much indebted for his constant attention, great building tact and skill, and the full exercise of his first-rate mechanical and constructive capacities in their service: he is evidently a man very superiorly calculated to conduct large masses of work, as well as their detailed arrangement, and appears to be quite at home in this department of the business. The ground is on an inclination, with gravel bottom and good water; but the site stands awkwardly with the road, seeing the back of the front building before you see its front elevation, which might have been easily remedied, notwithstanding the depth of the ground; however, considering the house is built for about 1150 inmates, at an expense of less than £24,000. It reflects infinite credit both on Mr. Browne who has had much trouble and opposition to contend with; Mr. Jay of London Wall, who has done himself credit in the execution; the Board of Guardians for their spirit in giving an impetus to the large house yet to be built, and all parties concerned in the erection of those truly National Establishments. I would have given you a detailed account but time presses on me, so beg the insertion of this brief notice.

M. N. O.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

GEOLOGICAL SOCIETY.

The first meeting of this society for the session was held on Wednesday evening, the 6th November.

Rev. Professor Buckland, D.D., President, in the chair.

The following communications were read:

A notice of Showers of Ashes which fell on board the Roxburgh, off the Cape de Verd islands, in February last, by the Rev. W. B. Clarke.

On Tuesday, February 4th, the latitude of the ship at noon was 14 deg. 31 min. north, longitude 25 deg. 16 min. west. The sky was overcast, and the weather thick and insufferably oppressive, though the thermometer was only 72. At 3 p. m. the wind suddenly lulled into a calm, then rose from the south-west, accompanied by rain, and the air appeared to be filled with dust, which affected the eyes of the passengers and crew. At noon, on the 5th of February, the latitude of the *Roxburgh* was 12 deg. 36 min. north, longitude 24 deg. 13 min. west; the thermometer stood at 72, and the barometer at 30—the height which it had maintained during the voyage from England. The volcanic island of Fogo, one of the Cape de Verds, was about forty-five miles distant. The weather was clear and fine, but the sails were found to be covered with an impalpable reddish-brown powder, which Mr. Clarke states resembled many of the varieties of ashes ejected from Vesuvius, and evidently was not sand blown from the African deserts. The author also mentions the following instances of similar phenomena, chiefly on the authority of the officers of the *Roxburgh*. In June, 1822, the ship *Kingston*, of Bristol, bound to Jamaica, while passing near Fogo, had her sails covered with a similar brownish powder, which, it is said, smelt strongly of sulphur. In the latitude of the Canaries, and longitude 35 deg. west, showers of ashes have been noticed two or three times. At Bombay, dust, on one occasion, fell on the decks of the vessels to the depth of an inch, and it was supposed to have been blown from Arabia. In January, 1838, dust was noticed by the crew of a ship navigating the China Sea, and at a considerable distance from the Bashee islands, one of which had been previously seen in eruption. In 1812 ashes fell on the deck of a packet bound to the Brazils, and when 1000 miles from land.

A letter from Mr. Caldclough, dated Santiago de Chili, February 18th, 1839, containing the declaration of the master and part of the crew of the Chilian brig, *Thily*, of the discovery during the evening of the 12th of February, of three volcanic islands about thirty leagues to the east of Juan Fernandez. The island which was first noticed, appeared, at the time of its discovery, to be rising out of the sea. It afterwards divided into two pyramids, which crumbled away, but their base remained above the level of a violent surge, and in the course of the same evening, the height of the island was, for a time, again considerably increased. The other two volcanic islets bore further southwards. During the night the crew of the *Thily* noticed, at intervals, a light in the same direction.

A letter addressed to Mr. Lyell, by Mr. Buddle, of Newcastle, *On Depressions produced on the Surface of the Ground by the Excavations of Beds of Coal.*

The effects described in this paper are stated to depend on the four following conditions:—

1. The depth of the seam of coal below the surface.
2. The thickness of the seam.
3. The nature of the strata between the seam of coal and the surface.
4. Whether the pillars of coal are wholly or partially removed.

If the depth from the surface does not exceed thirty fathoms, and sandstone forms the greater part of the mass overlying the seam, the subsidence is nearly, if not quite, equal to the thickness of the coal removed; but if "metal stone" or shale constitute the bulk of the beds, the hollow produced by the settling of strata is less. This rule, depending on the nature of the intervening mass, is said to be maintained at all depths. Of the proportional effect produced on the surface, Mr. Buddle has not been able to obtain any accurate information—the amount depending on the four conditions enumerated above; but the depth of the depression depends less on the thickness of the seam than on its entire removal. In the Newcastle pits, where large pillars of coal are left in the first instance, and when these are subsequently removed, blocks or "stooks" of considerable strength are suffered to remain, for the purpose of protecting the colliers from the exfoliation of the roof, the sinking of the superincumbent mass is retarded, and several years sometimes elapse before the excavation is completely closed, or the overlying strata are finally settled down. In the Yorkshire system, by which all the coal, with the exception of small temporary pillars, is removed in the first instance, the roof being supported by wooden presses and stone pillars, the overlying strata subside immediately after the coal is removed.

It is only where water occurs on the surface, or a railway traverses a coal-field, that the amount of depression can be accurately ascertained. In one instance, the removal of a bed of coal six feet thick, one-fourth having been left in "stooks," the depth being 100 fathoms, and the overlying strata principally sandstone, a pond of water accumulated to the depth of rather more than three feet, by the settling of the strata. In another instance, where a railway crossed a district from beneath which three beds of coal had been successively removed, it had been found necessary to restore the level of the railway three times. The aggregate thickness of the seams of coal was nearly fifteen feet, and the depth of the lowest 107 fathoms, of the highest seventy-three, and the mass of the overlying strata consisted of shale. The extent of each settlement was not measured, but the total was 5 feet 6 inches, and this comparatively small amount Mr. Buddle explains by the railway passing near one end of the excavated tract. A still higher seam is now in progress of being worked, and it affords an excellent opportunity for ascertaining the effects produced by the pressure of the superincumbent mass. Innumerable vertical cracks pass through the seam, as well as the pavement and roof, or the beds immediately above and below it, but they are perfectly close except around the margin of the settlement. Along this line the seam is splintered, the pavement and roof are fissured and bent down, and the cracks are frequently open. Within the area of the settlement, the pavement, on the contrary, is as smooth as if it had not been disturbed, the cracks are close, and the coal is not splintered, but rendered tougher, or, in the language of the colliers, more "woody." This effect Mr. Buddle ascribes to the escape of gas by the cracks, and the same changes are sometimes produced by other causes, when the coal is said to be winded.

KING'S COLLEGE, LONDON.

Department of Civil Engineering and Science applied to the Arts and Manufactures.

Regulations in respect to Certificates.

1. The certificates of the second and third years will be of two forms—ordinary certificates, and certificates of honour.

2. No certificate, whether ordinary or of honour, will be granted, which, among the signatures affixed to it. does not include those of the professors of mathematics, mechanics, and chemistry.

3. A certificate of the second year will be necessary to obtaining one in the third.

4. Any student to whom a certificate shall have been refused at the Midsummer examination of any year, may apply for it at the examination of the following Christmas.

5. Every student, desirous of obtaining a certificate in science applied to the arts and manufactures, will be required to present to the examiners the detailed description of some process of manufacturing art, accompanied by the drawings necessary to the explanation of it. This exercise is to bear a certificate of approval from the lecturer on manufacturing art and machinery; and the subject of it is to be appointed by him at least three months before the day of examination.

The certificate of honour will be granted only when this exercise shall have been approved by the lecturer, as the exercise of a candidate for that certificate.

6. Every student applying for a certificate in civil engineering, whether of the first or second years, will be required to present to the examiners finished drawings of the plan, elevation, and section of a machine, made under the eye of the teacher of drawing, and bearing his certificate of approval.

For the certificate of the third year these drawings are to be accompanied by others, showing the details of the machine, drawn in isometrical projection, or in common perspective.

For the certificate of honour in the third year, each candidate will be required to produce, in addition to the above, the geometrical constructions of at least six problems in descriptive geometry.

1. On the intersections of surfaces.
2. On tangent planes.
3. On developable surfaces.
4. On projections of the circles of the sphere.

7. The diploma of associate in the department of civil engineering and science applied to the arts and manufactures, will be granted to such students only as shall have received the certificate of the third year.

8. Only such students as may have received certificates of honour in the third year will be admitted candidates for the diploma of associate of the first class.

9. The examination for the diploma of associate of the first class, will be held at the Christmas which follows the examination of the third year. Every candidate for the diploma of associate of the first class, will be required to present to the examiners, in writing, on the day of examination, the original project of some public work or mechanical contrivance or process of manufacturing art, accompanied by the calculations, drawings, and descriptions necessary to its actual execution, to be specially approved by the lecturer on mechanical art and machinery as the exercise of a candidate for the diploma of associate of the first class, and to bear his certificate to that effect.

ROYAL SOCIETY.

Dec. 12.—Major Sabine, V. P., in the Chair. G. L. Roupell, M. D., was elected a fellow. The following papers were read:—

1. "*On the nerves of the Gravid Uterus*," by R. Lee, M.D.

2. "*Observations made at the Cape of Good Hope, in the year* 1838, *with Bradley's Zenith Sector, for the verification of the Amplitude of the Abbé de la Caille's Arc of the Meridian.*" By T. Maclear, Esq., communicated by Sir John Barrow, Bart.

The author gives an account of the precautions taken in putting together the different parts of the zenith sector, which he received on the 9th of December, 1837, in erecting it in the central room of the Royal Observatory, at the Cape of Good Hope, and in afterwards transferring it to the southern station of La Caille, in Cape Town. He then proceeds to describe La Caille's observatory, and the particular circumstances of its locality, with relation to the object in view—namely, to determine the influence of Table Mountain on the direction of the plumb line. He next relates his progress to Klyp Fonteyn, where he arrived on the 28th of March, 1838; and describes the operations resorted to for erecting the sector at that place. He then enters into the details of observations made at different stations, and especially with comparative observations at the summit and foot of the mountain of Pequet Berg. The instrument was, lastly, conveyed back to Cape Town, and again examined, and the observations made with it repeated. The reduction of the labours occupies the remainder of the paper; and, in conclusion, the author remarks, that, although these labours have not altogether cleared up the anomaly of La Caille's arc, yet they show that great credit is due to that distinguished astronomer, who, with imperfect means, and at the period in which he lived, arrived at a result derived from sixteen stars, almost identical with that from 1139 observations on forty stars, made with a celebrated and powerful instrument.

Dec. 19.—Major Sabine, V.P., in the Chair.

Henry Drummond, Esq., of Albany Park, Surrey, was elected a Fellow.

A paper was read, entitled "*An Account of Experiments made with the view of ascertaining the possibility of obtaining a spark* before *the circuit of the Voltaic Battery is completed.*" By J. P. Gassiot, Esq.

ROYAL INSTITUTION OF BRITISH ARCHITECTS.

At an ordinary General Meeting of the members, held on Monday December 16th, 1839, George Basevi, Jun. V. P., in the Chair, numerous donations were announced as having been received since the last meeting.

Mr. Cottam delivered a discourse on the manufacture of bricks by machinery, illustrated by models, and drawings of the Marquis of Tweeddale's machines for making of bricks and tiles.

January 6.—Thomas Chawner, Fellow, in the Chair.

The following gentlemen were elected: as Fellow, James Penythorne, Architect, of 2, Queen Square, Westminster; as Associate, James Bell, of Wandsworth.

Mr. Donaldson read a paper on the life of Ammanate, Architect of Florence.

January 20.—Edward Blore, V. P., in the Chair.

The following gentlemen were elected: as Fellow, John Crake, Architect, of Old Quebec Street; Associate, F. Ashton, of No. 2, Pelham Crescent.

Several donations were announced as having been received, among which was a donation of 10*l.*, by Thomas Chawner, Esq., Fellow.

A highly interesting paper of deep research was read by Edward I'Anson, Jun., on the Temple of Victory, Apteros, at Athens, accompanied by drawings illustrative of its state of restoration in the Spring of 1836.

Mr. Donaldson read a paper by Herr Hallemann, Architect, from Hanover, on the History of Grecian and Russian Ecclesiastical Architecture, illustrated by examples, and an original design

MEETINGS OF SOCIETIES IN FEBRUARY.

Institution of Civil Engineers, 25, Great George Street, every Tuesday at 8.

Royal Institute of British Architects, 16, Grosvenor Street, Monday 3rd and 17th, at 8.

Architectural Society, Lincoln's Inn Fields, Tuesday the 25th, at 8.

Society of Arts, Adelphi, every Wednesday at half-past 7.

Royal Society }
Society of Antiquaries } Somerset House, every Tuesday at 8.

PROCEEDINGS IN PARLIAMENT.

HOUSE OF COMMONS.

January 17, *Petitions for Bills presented.*—Arbroath and Forfar Railway; Sheffield and Rotherham Railway Act Amendment; Lancaster and Preston Railway Act Amendment; Chester and Birkenhead Railway; Taff Vale Railway; North Union Railway.

Jan. 20.—Edinburgh and Glasgow Railway.

Jan. 21.—Great Level of the Wash Inclosure.

Jan. 22, *Petitions referred to the Select Committee on Petitions for Private Bills.*—Arbroath and Forfar Railway; Sheffield and Rotherham Railway Act Amendment, referred to Select Committee on Petitions for Private Bills; Lancaster and Preston Railway Act Amendment, petition; Chester and Birkenhead Railway; Taff Vale Railway; North Union Railway; Edinburgh and Glasgow Railway; Glasgow, Paisley, Kilmarnock, and Ayr Railway. Railway Communication.—Select Committee appointed, "to inquire into the state of communication by railways, and to report their observations thereupon to the House:" Mr. Labouchere, Sir Robert Peel, Lord Granville Somerset, Mr. Thorneley, Lord Sandon, Mr. Loch, Mr. Freshfield, Sir John Guest, Lord Stanley, Mr. Greene, Sir Harry Verney, Mr. Henry Baring, Sir James Graham, Lord Seymour, Mr. Easthorpe, Mr. Emerson Tennent, and Mr. French:—Power to send for persons, papers, and records five to be the quorum.

STEAM NAVIGATION.

Steam Navigation.—We are much gratified to perceive the improved condition of seamen generally, and to hear congratulatory accounts on all sides respecting this desirable event. The infusion of young blood of the right quality, in the persons of upwards of twenty-four thousand apprentices, within the last five years, has had a marked effect upon the mass; for some thousands of these having completed their apprenticeship, are now become active able seamen. The number of apprentices reared in steam-vessels—(the General Steam Navigation alone maintain upwards of fifty, principally selected from the Naval Schools at Greenwich)—will become a most valuable class of men; and we have heard that the highly respectable firm of Seward and Co., so celebrated for their success in the manufacture and improvement of steam-engines, have how upwards of three hundred youths indentured as apprentices, with the view of their becoming engineers and assistant engineers in steam-vessels, and fully competent to repair any casualty in the engines that is practicable at sea, without the necessity for returning to port or laying up the vessel.—*Naval and Military Gazette.*

Improved Marine Engines.—A fine new iron steam boat, the property o Lord F. Egerton, or in other words of the Bridgewater Trust, was recently launched from the yard of Messrs. Page and Grantham. She was named the *Alice*, after Lord Francis Egerton's eldest daughter, is about 170 tons burden, old measurement, is neatly fitted up, and is a handsome lively looking boat on the water. With the whole of her machinery, fuel, &c. on board, her draft of water is only four feet six inches. She has two engines of 30 horse power each, made by Messrs. Devonport and Grinrod, of the Caledonian Foundry in this town, upon a novel and improved construction, their peculiarity consists in the fixing of the cylinders on an angle of 45 degrees in the form of a rectangle, with the hypothenuze at the base, so that they act as a stay and support to each other. No side levers *are required or counter balances;* and the working parts being fewer than in ordinary engines, they are less liable to derangement, and not so much exposed to *wear* and *tear*. These engines are exceedingly compact, and have realized all that was contemplated by the ingenious makers—ample power—ease in working, and great strength, combined with unusual lightness. At twelve on Saturday night several gentlemen proceeded in the vessel from the Clarence Dock on a short experimental trip on the river. New engines are necessarily stiff, and it requires some time to ascertain their proper adjustment. With all disadvantages, however, the *Alice* performed her work admirably, from the moment she left the dock. A very short trip only was intended on the first occasion; but the speed of the vessel was so satisfactory, and the gratification of all on board consequently so great, that she proceeded up the river a distance of 12 or 14 miles and back—accomplishing the trip "out and home" in about two hours. On her way up she beat several very powerful steamers, and on coming down successively headed two of the Runnora packets in gallant style. The strokes of the engine averaged thirty-two per minute, but when at her full power they will make thirty-five.—*Liverpool Standard, Dec.* 21.

HALL'S REEFING PADDLES.

"The inventor is Mr. Hall, the ingenious deviser of the condenser which goes by his name. By a contrivance of the utmost simplicity, all the float-boards of both paddle-wheels of a steam-boat, or either of them, can at any time, or in any weather, be 'reefed' in a few minutes; or, in other words, the diameter of the paddle-wheels be reduced from their extreme size to any other diameter. The advantages which will follow this contrivance are well-known to all persons who have attended personally to steam navigation; but a few words on this point will perhaps not be unacceptable to those who may not have had opportunities of studying the subject afloat under varied circumstances.

Every one can understand that, when a steam-vessel is loaded with a heavy cargo, or has a full supply of coals on board, the paddle-wheels will be sunk to an inconvenient depth in the water, and that, in order to enable them to work with advantage, the float-boards require to be unscrewed and shifted nearer to the centre of the paddle-wheel—an operation of some trouble, and often requiring much time. This adjustment may, of course, be made at the beginning of a voyage, according to the draught of water, but it may become fully as necessary to shift the paddle-boards during the voyage, either farther out or farther in. If the vessel, for instance, by the expenditure of her coals, becomes lighter, the float-boards should be moved out; or, if a gale comes on a-head, they have to be moved in; which operations, if they have to be done in bad weather, are both tedious and difficult. So that any invention which shall give the power of shifting the float-boards easily and quietly, must be of great practical utility, especially on long voyages.

"It is well-known to those who have attended to the subject that no steam vessel can be said to work to the full extent of her power unless her engines make a given number of strokes in a given time—say in a minute; the elasticity of the steam being supposed to continue uniformly of a certain determinate strength. Now occasions constantly arise when, in consequence of the paddle-wheels being too deeply immersed, or that the sea is high, the float-boards are made to impinge on the surface at such an unfavourable angle, and again on leaving it, that a considerable portion of the power is lost in production of what is called back-water. The consequence is, that the paddle-wheel is virtually so over-loaded, that the steam though generated of the proper degree of elasticity is not adequate to turn them round the given number of times. When this happens, as the engine does not make the number of strokes per minute which it ought to do when working at its maximum speed, one of two things must happen, either steam must be blown off and power wasted, or the fire must be lowered in order that no more steam may be generated than the engine, at its reduced number of strokes, can consume. In consequence of this state of things, it happens not unfrequently that vessels whose paddles are too deeply immersed, though carrying a high nominal power, are obliged to work with a power really much inferior.—*United Service Journal.*

The Great Western.—We are happy in being able to say that the examination of this noble vessel since her laying up shows that there is neither spot nor blemish in her, that she does not require caulking or coppering, beyond a few sheets to replace those which have been rubbed off by the coal vessels, or have been removed for the purpose of a thorough examination. All the parts of the engines which are not fixtures have been taken out and thoroughly examined, and are now in progress of replacement. The plan of the directors is to overhaul her completely once a year; and we should say after 35,000 nautical miles steaming per annum, an almost indispensable one, if confidence is to be maintained with the public. We understand that the poop deck is to be lengthened 16 feet; and that the whole of the officers, engineers, stokers, and servants, whose berths below were a great inconvenience and annoyance to the fore cabin passengers, are to be accommodated on deck; also that the fares are to be all equal in the fore and after accommodation, the fore state rooms having been considerably enlarged. She will sail on the 20th of February.—*Bristol Mirror.*

The President Steam-ship.—On Sunday the 5th ult., the Royal William steamer, on her passage from London to Plymouth, fell in with, off the Start, the magnificent steamer President, on her voyage from London to Liverpool, (to take in her machinery), in quite an unmanageable state, having rolled away her foremast, maintopmast, &c. The Royal William took her in tow, and brought her into the Sound during Sunday night. On Tuesday she was towed up to the dockyard by Her Majesty's steamer Carron, and the same evening one of the directors of the British and American Navigation Company, for whose service she is built, arrived from London to superintend her refitment.—*Plymouth Journal.*

The Armed Steamer, Nemesis.—There is now lying in the Half-tide Basin of the Clarence Docks, Greenock, a very beautiful iron steamer, constructed by Mr. John Laird, of North Birkenhead, bearing the above name. She is fitted up with one engine of 120 horse power, and armed with two 32-pound carronades, the one fore and the other aft, which move on solid swivel carriages. Her draught of water is under four feet. Her crew will consist of 40 men. She will, it is said, clear out for Brazil, but her ultimate destination is conjectured to be to the Eastern and Chinese seas. On Monday last she made an excursion as far as the Floating Light, for the purpose of trying her machinery, which was found to work admirably.—*Edinburgh Observer.*

Leith Harbour and Docks.—Messrs. Walker and Cubitt have given in their report, and the Treasury have decided on adopting Mr. Walker's plan.

PROGRESS OF RAILWAYS.

Sheffield and Manchester Railway.—Mr. Vignoles has resigned his office as engineer-in-chief, and Mr. Locke has been appointed to succeed him. The directors, we understand, intend pushing forward with all possible vigour the works between Glessop and the Manchester terminus, so as to be able to open in the first instance through that very populous and productive district. The works at the summit tunnel are making very satisfactory progress.—*Railway Times.*

Hull and Selby Railway.—We understand that Mr. Walker, the company's chief engineer, has been in Hull this week, and after examining the various works on the line, has reported very favourably as to the progress which is being made in them; the bridges over the rivers Ouse and Derwent are in an advanced state of forwardness, and will both be completed in a few weeks; nearly the whole of the line is ballasted, and several miles of the permanent single way, on longitudinal bearers and cross sleepers, are already laid: large quantities of these are being constantly forwarded to the various portions of the line. The depôt and other buildings at Selby are in a very advanced state; this is also the case with those at the Hull terminus; and, although the past season has been a most unfavourable one for all railway works, it is still hoped that this undertaking will be ready to be opened for the whole length about Midsummer next. With respect to finances, we understand that the whole of the amount to be taken upon loan has been obtained without advertising, and the last call, notwithstanding the pressure upon the money market, has been remarkably well paid. We may congratulate our townsmen especially, and the inhabitants of the manufacturing districts of Yorkshire and Lancashire generally, on the prospect of speedily being enabled, by means of the Hull and Selby Railway, (connected as it is with the Leeds and Selby, the York and North Midland Counties, Manchester and Leeds, Manchester and Liverpool, Grand Junction, and London and Birmingham Railways,) to travel by this cheap, safe, and expeditious mode to all the principal towns in the kingdom. We are happy to learn that the price of shares in the Hull and Selby Railway is rapidly advancing in the market, and that before the opening of the line, as above stated, they are likely to be at par.—*Eastern Counties Herald.*

Edinburgh and Glasgow Railway.—We are glad to learn from a correspondent who lately visited the Edinburgh and Glasgow Railway works, now in progress, especially those through the Almond Valley, about eight miles from Edinburgh, under contract by Messrs. John Gibb and Son, on which there is one bridge of thirty-six arches, of fifty feet span each, besides numerous smaller bridges, extensive earth-cuttings, &c., that these gentlemen contemplate employing on these works, early in the spring, a vast number of masons, quarriers, earth-workers, and waggon-drivers. We have no doubt that this will be good news to many, especially as trade in the manufacturing districts is in such a depressed state.—*Aberdeen Journal.*

Dundee and Arbroath Railway.—This great public undertaking is nearly completed, the embankment has been formed up to the Gas Work, and in the course of two or three weeks the embankments from the east and west will have nearly met. As an arrangement has now, we believe been made with the Harbour Trustees, the public will soon have the full benefit of this conveyance from Trades-lane to Arbroath, and the inconvenience and trouble occasioned by the omnibuses will be avoided. It is said there will be a grand opening on the completion of the line; and it is not unlikely that Lord Panmure, who has all along manifested the greatest interest in the work, will be present. There are four vessels in a dangerous situation, as they will be closed in unless they get launched at the next stream tide; the parties will have themselves to blame if such an event takes place, the vessels being all ready for launching.—*Dundee Courier.*

Maryport and Carlisle Railway.—At a meeting of the directors of this railway, held on Saturday last, there was a report upon the state of the works, &c., by John Blackmore, Esq., lately appointed engineer to the company. It appears that about seven miles of the railway will be ready for the carriage of coal and lime about the first week in April next. Arrangements were entered into with parties desirous of taking coals along the line for shipment at Maryport, from which it is evident that an income will at once be realized sufficient to pay ten per cent. upon the amount of capital that will then have been expended, and this without taking into account any other source of traffic or the increase of coal that will undoubtedly take place. While upon this subject we beg leave to warn those shareholders, particularly the distant ones, who have not the opportunity of gaining correct information about the proceedings of the company, against a practice that has lately become too common of parties who calumniate and depreciate the value of property of the above description for the purpose of getting shares from the timid or needy at very reduced prices. The engineer has commenced the necessary surveys for setting out the work on the remaining twenty miles, from Carlisle to Aspatria, and for enabling the agreements to be made for the land required. —*Carlisle Patriot*, January 11.

Great North of England Railway.—Two first-class railway carriages have just been placed on the line of the Great North of England Railway, at the Darlington Station. The carriages, which are from the manufactory of Mr. C. Burnup, of this town, are of the most splendid description, and combine every improvement that has hitherto been introduced. The interior arrangements are exceedingly comfortable, and the exterior decorations are beautifully executed, each door panel bearing the united arms of Newcastle, Durham and York, supported by the Northern Eagle. The carriages have since been inspected by several of the directors and engineers, who all express their entire satisfaction and admiration of their beauty and useful construction. It is expected that the portion of the line between Darlington and York, will be opened to the public in the course of the ensuing summer.—*Newcastle Journal.*

London and Birmingham Railway.—Saturday evening a considerable subsidence took place at the Blisworth embankment, half way between the station and the bridge over the canal. The earth having become thoroughly saturated by the late rains, gave way at the bottom, and the surface in consequence gradually sunk, at one point several feet. Since then it has continued to subside at the rate of about a foot an hour, and on one occasion between two and six in the morning, when the men ceased to work, it sank eight feet. A large force of men were collected the moment the slip was discovered, and employed day and night replacing the soil that had given way with ballast, the trains in the mean time passing slowly over the spot. The gap is always filled up by the arrival of a train, and the precautions taken are such as to do away with all idea of danger. The ballast is brought partly from Bugbrook, but chiefly from Hillmorton, about 16 miles distant.—*Northampton Mercury*, January 11.

Railway Speed.—Last week we referred to the facilities afforded by the Great Western Railway in the conveyance of newspaper expresses from Monmouth, and noticed the great rate of speed at which the special trains on these occasions had run. The *Dispatch* (Sunday paper), in alluding to one of its own expresses, states that the *Æolus* engine performed the first *ten* miles in *seven* minutes, and that if the engineer had not been compelled to slacken his speed in consequence of a train having started a short time previously, the whole distance of 31 miles could easily have been accomplished in 25 minutes. This is at the rate of 74 miles an hour!—*Railway Times*, Jan. 18.

London and South-Western Railway.—The whole of the rails being now laid down between the temporary terminus at Northam and the terminus on the Marsh, the engine has several times been along the whole line. The building on the Marsh is also completed, and rising, as it does, higher than any of the adjacent edifices, forms a very conspicuous object, especially when viewed from the water. Workmen are actively engaged on the yet unfinised part of the line between Winchester and Basingstoke, and though the late unseasonable weather has impeded their progress in a great degree, little doubt is entertained of their completing it by the 1st of May, when the good folks of Southampton will be enabled to reach the metropolis in three hours.—*Southampton paper.*

Morecombe Bay.—By the intended enclosure of Morecombe Bay and the Duddon Sands, 52,000 acres of land will be reclaimed, which will form two of the most beautiful valleys in the lake district of 83 square miles. The sands, being composed almost entirely of calcareous matter washed from the surrounding limestone, are capable of being formed into the most fertile soil for agriculture. The land proposed to be reclaimed, will form an area half the size of Rutlandshire, and, calculating one individual for two acres, will accommodate a population of 26,000, being about half the number of the present population of the counties of Huntingdon and Westmoreland, and, 5,000 more than that of Rutland. It would be about equal in population and extent to Lonsdale North, which is a peninsula lying between the two bays of Morecombe and the Duddon, on which stand the ancient ruins of Furness Abbey, and is also a rich agricultural and manufacturing district, abounding with slate, iron, and copper mines. By the reclaimed land being added to it, Lonsdale North would form one of the most pleasant and compact counties in the kingdom.—*Lancaster Guardian.*

Maidenhead Bridge on the Great Western Railway.—A correspondent informs us that during the hurricane of Friday, the 24th ult., the timber centerings of the bridge, which had been left standing under the arches for some time past as a precautionary measure, were completely carried away by the force of the wind and the timbers scattered about the river in all directions. This event will now decide whether the bridge will stand or not without the aid of the centres, it is very evident that the brickwork of the arches was not supported by the centres, as some have supposed, for if that had been the case, they could not have been so easily carried away.

NEW CHURCHES, &c.

Blackheath.—A new church intended for the accommodation of about 1100 persons is in progress of erection at Lee, near Blackheath. It is designed in the first pointed or early English style, adopting as a model for the component parts of the exterior, the Lady Chapel of Salisbury Cathedral. At the west end placed centrally rises a bold tower, which is surmounted by an octagonal belfry and spire, reaching to the height of 130 feet. The interior is divided into a nave and aisles by two ranges of clustered pillars, from which spring molded arches supporting the roof, the latter is of a triplex form the central division rising from nearly the same level as the sides, so that there is no clerestory. The ceiling is to be finished in a style posterior to that of the building generally, it will consist of plane surfaces divided into principal compartments by hammer beams or arched ribs, and these compartments subdivided into panels by smaller ribs, having bosses at their intersections. A gallery is to be placed at the west end of the church, occupying lengthwise its entire width, and one bay or intercolumniation in depth. The whole area of the building has been excavated and a vaulted crypt formed, which is to be divided into numerous compartments, to be appropriated as family vaults. The external dressings throughout, together with the whole of the belfry and spire, as well as the pillars and arches of the interior are executed in stone.

Wolverhampton.—The erection of the new church in Horsley Fields will be commenced as soon as the necessary legal forms are completed. The building, as before stated, will be in the gothic style, and according to the design sent in by Mr, Harvey Eginton, of Worcester. Twenty-five plans were sent in, but several of them were unavoidably rejected on account of the cost of the proposed buildings exceeding the funds at the disposal of the committee. The structure will be eighty feet long and fifty-six feet wide, and is to be surmounted by a tower eighty-four feet high, in the style of the time of Henry VII. It will contain sittings for 1,200 persons, one-third of which are to be free.—*Wolverhampton Chronicle.*

Calcutta.—The Bishop of Calcutta has proposed building a cathedral church at Calcutta, in the Gothic style of architecture; unencumbered with galleries; with an ample chancel or choir; with north and south transepts or entrances; and capable of seating about 800 or 1,000 persons, its dimensions being probably somewhere about 180 or 200 feet, by 55 or 60; and 50 or 60 feet in height. In correspondence with this necessary magnitude of the body of the edifice, it is designed that the exterior of the building should bear some relation in its architectural character to the interior; and that an appropriate spire, somewhere about 200 feet in height from the ground, should be added, to give the whole a becoming and customary ecclesiastical aspect. It was, indeed, the unavoidable extent of a building which could at all meet the actual wants of the case in a climate like Bengal that first suggested the idea of erecting it in an open and beautiful spot, and of such a style of architecture as to form a prominent object from every point of view on the esplanade, within the fine panorama of Calcutta, and thus constitute the greatest ornament of what has not been unfitly termed the City of Palaces. And it was thought there are few who would not willingly make an additional effort—if we once determine to build a new and large church—to give it all the advantages which the progress made of late years in sacred architecture can secure, so as to render it fitting to be the first Protestant cathedral erected to the honour of God in India.

Liverpool.—The first stone of a new church, to be called after St. Barnabas, to be erected on a plot of land between Parliament-street and Greenland-street, a few yards from the Queen's Dock, was laid on Tuesday, December 17. St. Barnabas' church will be a handsome structure, in the early English or Lancet style, and a decided ornament to that part of the town. The principal elevation will be towards Parliament-street, and from the centre there will rise a beautiful tower and spire to the height of 135 feet. The former will be finished with a pierced battlement on four sides and shafts with pinnacles at the angles. The whole will be faced with red stone in large courses. The interior will correspond with the general style. It will have a nave separated from the aisles by moulded stone piers and arches, supporting a clear story in which there will be windows of three lights. The ceiling is to be ribbed and pannelled, and the ribs will be painted to resemble oak. It is intended to furnish 1200 sittings; on the ground floor there will be 471 sittings and 236 free sittings, in the gallery 346 sittings and 147 free, making 1200, of which 383 will be dedicated to the use of the poor for ever. The cost will be upwards of £4800. The architects are Messrs. Arthur and George Williams, of No. 2, Tarleton-street, and Mr. William Morrison, of Toxteth-park, is the contractor.—*Liverpool Standard.*

The new church at Boughton, in this county, which has been built upon a wet loose soil, has been some time subsiding, but the late rains have so impaired the foundation that the tower at the western extremity first sunk, and then fell to the ground, and the other appears also to be sinking very fast. Of course the whole presents a very ruinous appearance.—*Kent Herald.*

GEOLOGY.

Geology in Devon.—Dr. Buckland and Mr. Conybeare have both hastened to visit the late landslip on the coast of Devon, which, we understand, offers some very curious phenomena to the geologist both inland and out at sea, where, at a considerable distance from the shore, a new solid ridge has been thrown up by this convulsion of nature.—*Naval and Military Gazette.*

The Lagoons.—A Vienna correspondent of a Paris paper states that accounts had been received from Venice of the disappearance of a little island of the Lagoons in the waves of the Adriatic, 12 persons who were on it having been buried in the waters when the island was overwhelmed. The Archduke, Viceroy of the kingdom of Venetian Lombardy, had gone from Venice to Padua to inspect the ravages caused by the late inundations, and the clergy of Milan and Cremona were exerting themselves to relieve the sufferers.

Earthquake at San Salvador.—We have been favoured with the following extract of a letter from San Salvador, dated the 5th of October, 1839:—"On the 1st instant, at 2 a.m., we experienced a strong shock of an earthquake, and at 3 a.m., an hour after, a concussion which has nearly destroyed the town. The shocks continue, and yesterday we had 15 tolerably smart shocks. Many people have left the place, and I fancy the Government will remove to Cojntopeque, as this town is not safe. The evil is under our feet; for at places five or six miles off nothing has occurred. The houses are nearly unroofed, and the walls are so tottering that we all sleep in the court-yard or the great square, under hide coverings, which is pleasant enough in the rainy season, and sit in the day time in the corridors ready for a start into the yard, as it will not do to wait a moment when the shock comes."

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 1st TO 28th JANUARY, 1840.

John Leo Nicolas, of the parish of Clifton, Bristol, Gentleman, for "*certain improvements in the method of constructing and propelling carriages on railways or common roads, and through fields for agricultural purposes.*"—Sealed, January 1; six months to specify.

Samuel Lawson, of Leeds, and **John Lawson**, of the same place, Engineers, and Co-partners, for "*improvements in machinery for spinning, doubling, and twisting flax, wool, silk, cotton, and other fibrous substances.*" Communicated by a foreigner residing abroad.—January 2; six months.

Charles Greenway, of Douglas, in the Isle of Man, Esq., for "*certain improvements in reducing friction in wheels of carriages, which improvements are also applicable to bearings and journals of machinery.*"—January 3; six months.

John Francois Victor Fabien, of King William Street, in the city of London, Gentleman, for "*improvements in pumps.*"—January 7; six months.

David Low, of Adam's Court, Old Broad Street, Merchant, for "*improvements in machinery for crushing, preparing, and combing flax, hemp, phormium tenax, and other fibrous substances.*" Communicated by a foreigner residing abroad.—January 7; six months.

Moses Poole, of Lincoln's Inn, Gentleman, for "*improvements in obtaining power.*" Communicated by a foreigner residing abroad.—January 7; six months.

John Ridgway, of Cauldon Place, Stafford, China Manufacturer, for "*an improvement in the moulds used in the manufacture of earthenware, porcelain, and other similar substances, whereby such moulds are rendered more durable.*"—January 11; six months.

John Ridgway, of Cauldon Place, Stafford, China Manufacturer, and **George Wall**, the younger, of the same place, Gentleman, for "*certain improvements in the manufacture of china and earthenware, and in the apparatus or machinery applicable thereto.*—January 11; six months.

John Ridgway, of Cauldon Place, Stafford, China Manufacturer, and **George Wall**, the younger, of the same place, Gentleman, for "*certain improvements in the mode of preparing bats of earthenware and porcelain clays, and forming or shaping them into articles of earthenware and porcelain, and in the machinery or apparatus applicable thereto.*"—January 11; six months.

Robert Montgomery, of Johnstone, in the county of Renfrew, Gentleman, for "*an improvement or improvements in spinning machinery, applicable to mules, jennies, slubbers, and other similar mechanism.*"—January 11; six months.

Christopher Edward Dampier, of Ware, Attorney-at-law, for "*an improved weighing machine.*"—January 14; four months.

Hezekiah Marshall, of the city of Canterbury, Architect, for "*improvements in window sashes and frames, and in the fastening of window sashes.*"—January 14; six months.

Arthur Eldred Walker, of Melton Street, Euston Square, Engineer, for "*improvements in engraving by machinery.*"—January 14; six months.

Charles Wheatstone, of Conduit Street, Hanover Square, Esq., and **William Fothergill Cooke**, of Sussex Cottage, Slough, Esq., for "*improvements in giving signals and sounding alarms at distant places, by means of electric currents.*—January 21; six months.

Samuel Brown, of Finsbury Pavement, Civil Engineer, for "*improvements in making casks and vessels, of or from iron, and other metals.*—January 21; six months.

Joseph Rock Cooper, of Birmingham, Gun Maker, for "*improvements in fire-arms, and in the balls to be used therewith.*—January 21; six months.

William Stone, of Winsley, Gentleman, for "*improvements in the manufacture of wine.*"—January 21; six months.

James Hall, of Glasgow, Upholsterer, for "*improvements in beds, mattrasses, and apparatus applicable to bedsteads, couches, and chairs.*—January 21; six months.

Arthur Howe Holdsworth, of Brookhill, Devon, Esquire, for "*improvements in preserving wood from decay.*"—January 21; six months.

William Coltman, of Leicester, Frame Smith, and **Joseph Wale**, of the same place, Frame Smith, for "*improvements in machinery employed in making frame-work, knitting, or stocking fabrics.*"—January 21; six months.

Samuel Wilkes, of Darlston, Iron Founder, for "*improvements in the manufacture of hinges.*"—January 21; six months.

George Wilson, of Saint Martin's Court, Saint Martin's Lane, for "*an improved paper-cutting machine.*"—January 21; six months.

Charles Rowley, of Birmingham, Stamper and Piercer, and **Benjamin Wakefield**, of Bordesley, Machinist, for "*improved methods of cutting out, stamping, or forming, and piercing buttons, shells, and backs for buttons, washers, or other articles, from metal plate, with improved machinery and tools for those purposes.*—January 21; six months.

Edward Halliley, of Leeds, Cloth Manufacturer, for "*improvements in machinery for raising pile on woollen and other fabrics.*—January 21; six months.

William Hunt, of the Portugal Hotel, Fleet Street, London, Manufacturing Chemist, for "*improvements in the manufacture of potash and soda, and their carbonates.*"—January 21; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in the manufacture of prussiate of potash and prussiate of soda.*" Communicated by a foreigner residing abroad.—January 21; six months.

Jules Alphonse Simon de Gournay, of Bread Street, London, Gentleman, for "*improvements in the manufacture of horse-shoes.*" Communicated by a foreigner residing abroad.—January 21; six months.

George Clarke, of Manchester, Manufacturer, for "*certain improvements in the construction of looms for weaving.*"—January 21; six months.

Alexander Helt, of Gower Street, Bedford Square, Surgeon, for "*certain improvements in the arrangement and constructian of fire-grates, or fire-places, applicable to various purposes.*"—January 23; six months.

James Bingham, of Sheffield, Manufacturer, and **John Amory Boden**, of the same place, Manufacturer, for "*certain improved compositions, which are made to resemble ivory, bone, horn, mother-o'-pearl, and other substances, applicable to the manufacture of handles of knives, forks, and razors, piano-forte keys, snuff-boxes, and various other articles.*"—January 25; six months.

James Smith, Junior, and **Francis Smith**, of Spital Works, near Chesterfield, Lace Manufacturers, for "*certain improvements in machinery for the manufacture of figured bobbin-net, or lace.*—January 28; six months.

Thomas Aitken, of Chadderton, Manufacturer, for "*certain improvements in the machinery or apparatus for drawing cotton and other fibrous substances.*"—January 28; six months.

William Pontifex, of Shoe Lane, in the city of London, Coppersmith, for "*an improvement in treating fluids containing colouring matter to obtain the colouring matter therefrom.*"—January 28; six months.

Henry Curzon, of the borough of Kidderminster, Machinist, for "*certain improvements in steam-engines.*"—January 28; six months.

John Whitehouse, of West Bromwich, in the county of Stafford, Iron Master, for "*improvements in preparing and rolling iron, and other metals, or metallic alloys, for the manufacture of certain articles of commerce.*"—January 28; six months.

William Mottershaw Forman, of Sheepshead, in the county of Leicester, Frame Smith, for "*certain improvements in stocking frames, and machinery used in frame-work knitting.*"—January 28; six months.

TO CORRESPONDENTS.

In consequence of the great advantages to correspondence by the universal introduction of the penny post throughout the United Kingdom, we hope that our readers will do us the favour to forward accounts of all new buildings, public works, new inventions and discoveries, reports of scientific meetings, new engines, steam boats, docks, canals, harbours, &c., if a tithe of our readers will only take the trouble to forward a dozen lines monthly, it will be the means of affording such a mass of information, that could not fail to be most valuable to the profession.

We thank our correspondent at Montreal for his letter, we think that he and his professional brethren might obtain the Journal in a far more direct manner, than through the circuitous and expensive channel of New York. We advise him to consult a respectable bookseller, or some agent who is in constant correspondence with England. We shall be happy to receive the information he proposes.

We feel particularly obliged to our correspondent Mr. W. R. Casey *of New York, for his valuable contributions, we hope to have a continuation of them.*

A correspondent requests us to publish the description of the Epicycloidal motion for a steam engine which we stated was not new. We will, if we can find room, do so next month, ro refer him to works and places where it may be seen. The last time we visited the Arsenal at Woolwich, we saw the motion applied to the working of a perpendicular saw for cutting timber.

R. W. T.'*s last letter we will answer next month. His former communication was received, we did not insert it as we were desirous of avoiding the insertion of any further articles on railway curves.*

Diogenes' *apparatus for stopping carriages on railways will appear next month, will* Diogenes *be so good as to inform us if it be the same apparatus as Thompson's alluded to in his paper in last month's Journal.*

I. Z.'*s drawing for a paddle wheel with reefing paddles, constructed by Boulton and Watt, in* 1815, *will appear next month.*

H. B.'s *syphon for a high pressure steam gauge we will notice if we can spare the room next month.*

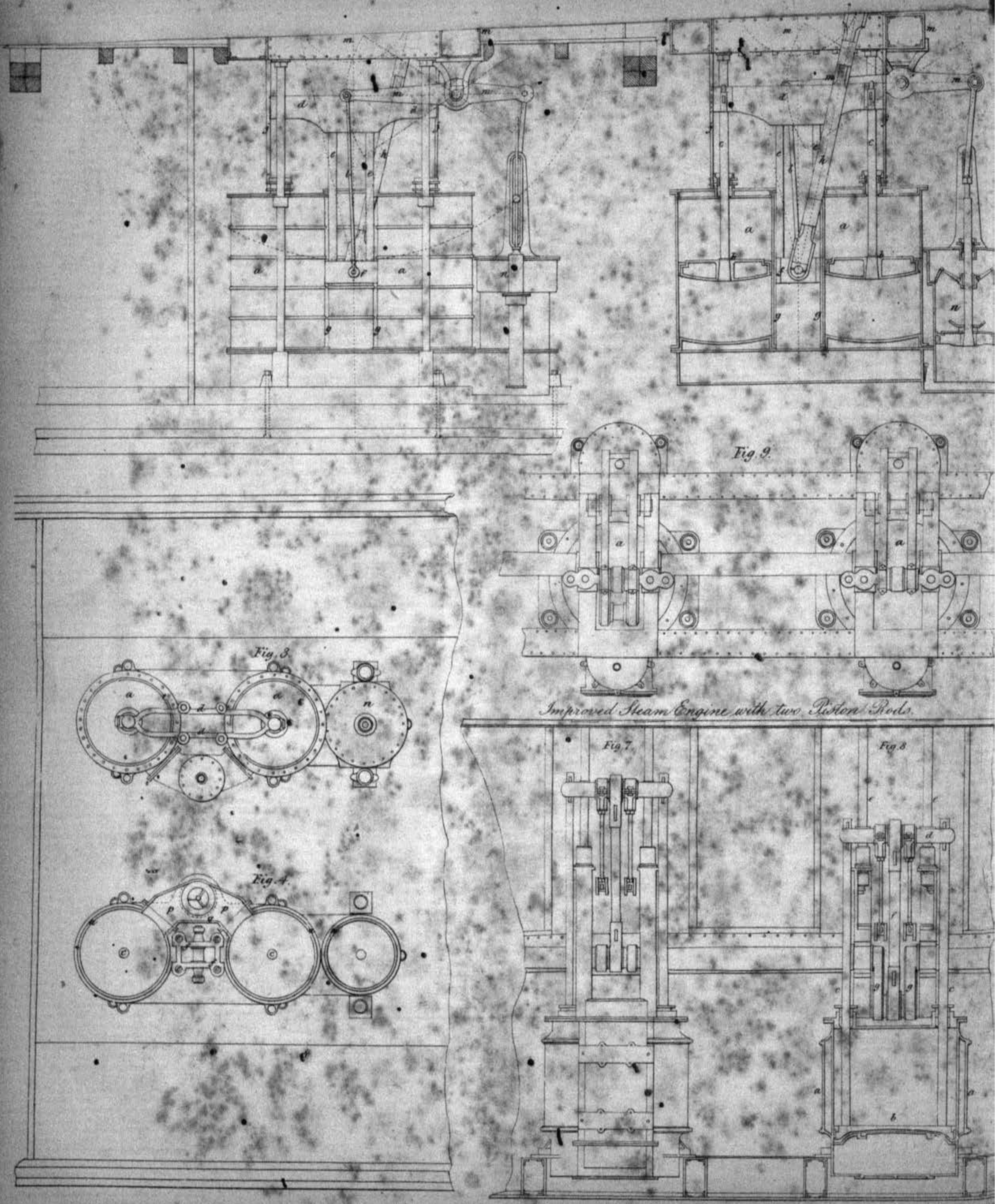
We have this month made an alteration in the Journal by the introduction of engravings instead of wood cuts; this plan we shall occasionally adopt when the subjects for illustration are of a minute character. At the end of the year, when the numbers are bound up, the plates will be placed opposite to the letterpress referring to them.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, to be directed to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17s.

⁂ The Second Volume may also be had, Price 20s.



Improved Steam Engine with two Piston Rods.

J. K. Jobbins, Warwick Court.

Improved Steam Engine with two Cylinders.

Fig. 5.

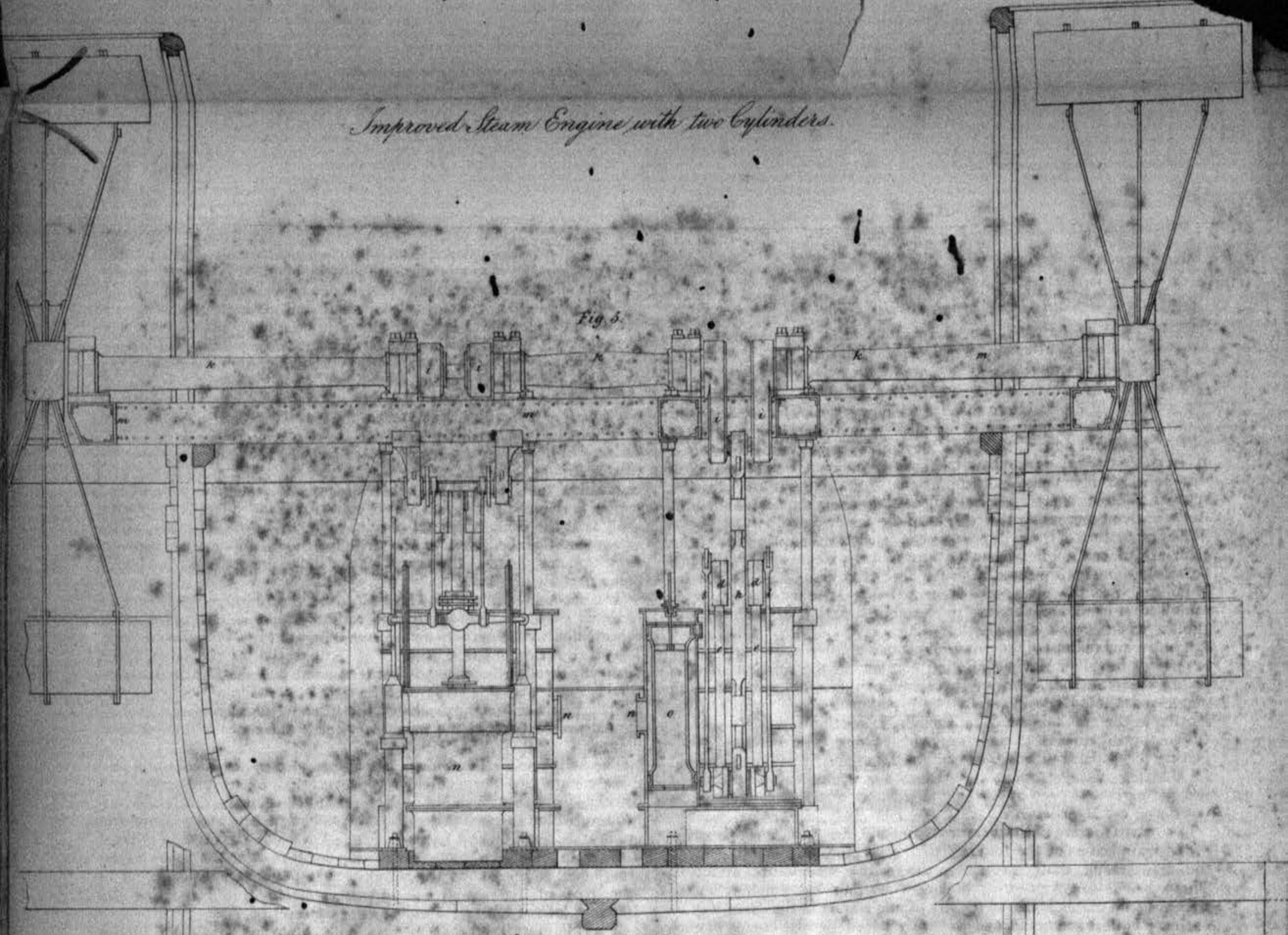
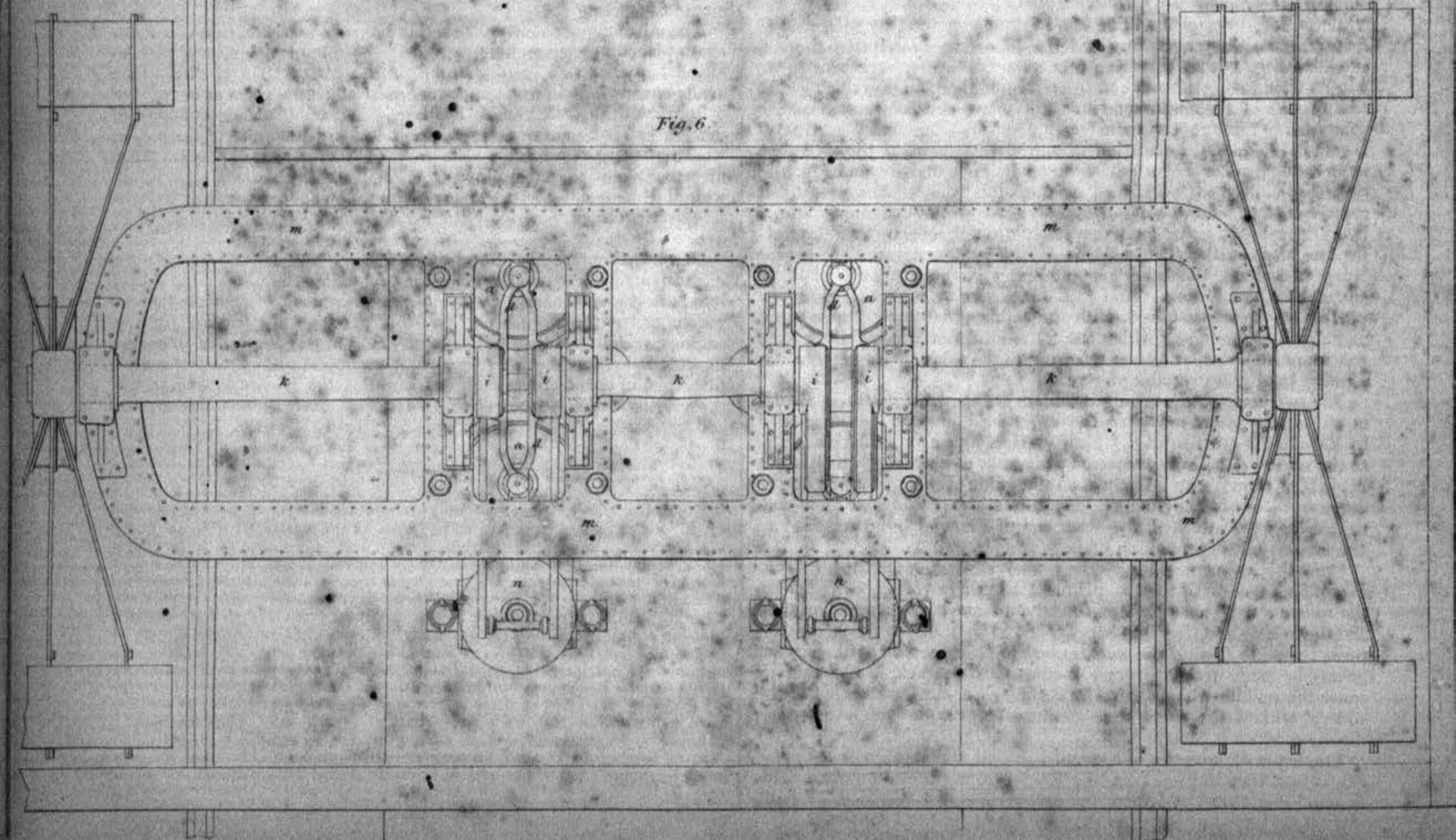


Fig. 6.



IMPROVEMENTS IN THE CONSTRUCTION OF MARINE STEAM ENGINES,

WHICH ARE PARTICULARLY APPLICABLE TO STEAM ENGINES OF THE LARGEST CLASS.

With two Engravings, Plates V and VI.

SPECIFICATION *of a Patent granted 7th May,* 1839, *to* JOSEPH MAUDSLEY *and* JOSHUA FIELD, *of the firm of Maudsley, Sons and Field, Engineers of Lambeth.*

THESE improvements in the construction of marine steam engines are particularly applicable to those of the larger class, and are designed principally for the purpose of producing and applying a greater amount of steam power, than has heretofore been available within a given space or area on shipboard. This is effected by different constructions, arrangements, and proportions, of the parts of low pressure engines, allowing a more perfect application of the expansive force of steam without increasing the weight of the whole machinery.

The first feature of these improvements consists in adapting two steam cylinders to one engine, in such a way that the steam shall act simultaneously upon both pistons, in order that they may be made to rise or fall together, the piston-rod of each being attached to one horizontal cross-head, and thereby the combined action of both pistons applied to one crank of the paddle-shaft.

The second feature of these improvements applies more particularly to engines for river navigation, and consists in the adaptation of a piston with two rods, working in a steam cylinder of large area, both piston-rods being connected to one cross-head above, which gives motion to the crank below it, by a single connecting rod.

The third feature of these improvements consists of a method of adjusting the expansion valves of combined engines, by which the period for shutting off the steam at any part of the stroke may be regulated in both engines at once by a single movement, whilst the engines are working.

The fourth feature of these improvements is the peculiar construction of the main beams of the framing that carry the plummer blocks of the main crank shaft, to which the paddle-wheels are attached. These beams are formed as hollow trunks, by the combination of wrought iron plates attached to bars of angle iron, in the same way as ordinary boilers are made, and we are enabled by that means to construct beams of the largest dimensions of unlimited strength and of comparatively small weight.

These improvements will be more fully understood by reference to the accompanying engravings and the following description thereof, in which Fig. 1 is an elevation taken longitudinally, representing an engine with two cylinders, constructed upon the plan described as the first feature of the improvement. Fig. 2 is a vertical section of the same, taken through the cylinders. Fig. 3 is a horizontal section of a vessel, in which the situation of the engine shown at Fig. 1 is seen as it would appear when looking upon it from above; and Fig. 4 is a corresponding engine placed at the other side of the vessel, but represented in section cut horizontally through the cylinders. Fig. 5 is a vertical section taken transversely through a steam vessel, showing the positions of two engines, as in Figs. 3 and 4, the one engine being in section, the other an external view seen upon a plane in advance of the former. And Fig. 6 is a plan or horizontal view of a portion of the steam-vessel, with the engines and their appendages, and also the framing by which the crank-shafts of the paddle-wheels are supported, similar letters referring to the same parts of the machinery in all the preceding figures.

The two connected working cylinders are shewn at *a a*, their pistons at *b b*, and the piston rods at *c c*, the upper ends of which rods are affixed by keys to the cross-head *d*. Four vertical rods *e e e e*, affixed at top to the cross-head *d*, are connected at bottom to a slider *f*, which slider is enabled to move up and down on the guide-ribs *g g*, formed on the outer surfaces of the cylinders. To this slider *f* one end of a connecting rod *h* is attached, the other end of that rod being attached to the crank *i* of the propelling shaft.

From this arrangement it will be perceived that, by the simultaneous ascent and descent of the two pistons *b b* in their working cylinder *a a*, the rods *c c* will cause the cross-head *d* to move perpendicularly up and down between its guide bars *j j*, and in so doing to raise and depress the slide *f*, with the connecting rod *h*, which rod will, by that means, be made to give rotary motion to the crank *i*, and thereby cause the paddle-wheel shaft *k* to revolve. A rod *l*, connected to the slide *f*, will at the same time work the lever *m*, to which the rod of the air-pump *n* is attached.

The mode of adapting the steam-valve of the combined cylinders *a a*, is best seen in Figs. 3 and 4. The steam is admitted to, and withdrawn from, these cylinders, by one slide valve common to both, through a pipe *n*, seen in Fig. 5. From this pipe *n* the steam proceeds, through a slide valve *o* of the ordinary construction, and through the curved passages or tubes *p p* into both cylinders. There is also a narrow passage of communication always open at *q*, by which the steam is allowed to pass from one cylinder to the other for the purpose of keeping the pressure equal at all times in both cylinders.

The expansion valve is on the steam-pipe *n*, at the entrance to the slide valve. The slide is moved by an eccentric in the ordinary way; and the expansion valve is regulated by the means described hereafter under the third feature of the invention.

The advantages proposed by this arrangement are, simplicity of construction, more direct action on the crank, saving of space and weight of material, offering every means of giving larger area of cylinder, whereby a given amount of steam can be used more expansively than in former arrangements, and consequently yield more power and economize fuel, with the further advantage at sea, that when the engine is reduced in the number of its strokes by deep lading with coal, as at the commencement of a voyage, or by head winds, more steam may then be given to the cylinders, and, under such circumstances, more speed to the vessel, all the steam generated in the boiler being usefully applied.

The second feature of this invention, viz. the improved construction of steam engine having two piston rods working in one cylinder, is represented in the accompanying engravings at Figs. 7, 8, and 9. Fig. 7 is an elevation of the engine. Fig. 8, a section of the same, taken vertically through the cylinder, with the crank and shaft of the paddle-wheels; and Fig. 9 is a horizontal view, as seen from above, of the two engines and their appendages, the same letters of reference pointing out similar parts of the machinery in all the three last mentioned figures.

The cylinders of large area are shown at *a a*, and *b* are their pistons; *c c* are two perpendicular rods inserted into each piston, and working through stuffing boxes in the lid of the cylinder; *d* is a cross-head, to which the two piston-rods are keyed at top, and *e e* are the guide-rods, fixed on cast iron supports, upon which rods the cross-head *d* slides up and down. The connecting rod *f* is attached above to the cross-head, and below to the crank *g g* on the paddle shaft. The other parts of the engines will appear so obvious from inspecting the drawings, as not to require any further description.

It will be perceived that by this arrangement of the parts of the engine, motion is given to the crank-shaft below the cross-head, by a single connecting rod.

The advantages resulting from this improvement are, that a paddle-shaft, placed at a given height from the bottom of the vessel, will be enabled to receive a longer stroke of the piston than by any other arrangements now in use, a more compact and firm connection of the cylinder with the crank-shaft bearings is effected, and a cylinder of much greater diameter may be applied, by which the principle of working steam expansively may be more fully carried out, and a more direct action of the steam power on the crank obtained, with a less weight of materials and a greater economy of space than has heretofore been attained, by any of the arrangements of marine engines in use.

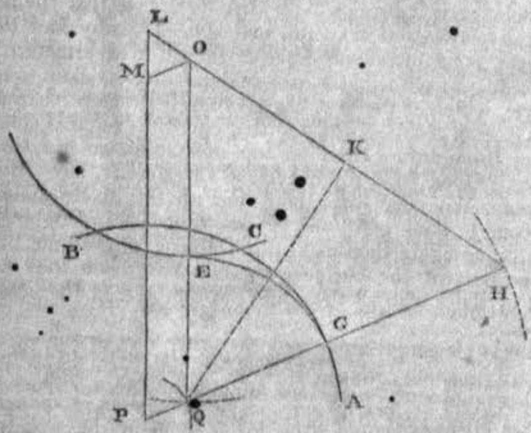
The third feature of the invention, viz. the method of adjusting the expansive valves of combined engines, regulates the flow of the steam into both engines at once, by one simple movement of the spindle and pinion, and without interrupting for a moment the working of the engines, such a means of adjustment being highly important in bringing into operation the full effect of steam applied upon the expansive principle, in economizing fuel, and adapting the power of engines to the varying circumstances at sea, between light and heavy lading, and between strong head-wind and scudding before the gale.

EXTENSIVE USE OF SLATE.—Slates are now applied to purposes unthought of till lately; and when deposited in drains, as the bottoms of tiles, are found as efficacious in keeping the land, as houses, dry. Compared to dressed free-stone, or flat tile, they are at once lighter and less expensive; ease in handling is a great advantage, and equally, or more so, the alleged property of "lasting for ever." Mr. Lawrie, Terregles-town, was foremost in trying the experiment in Dumfriesshire, and his expectations have been so fully realized that his example will be very generally followed wherever drains remain to be cut, and that is sectionally, at least almost everywhere. Of the article in question he has imported from Bangor 200,000 bottoms or pieces, and may have occasion to commission further cargoes. The first imported measured six inches by five: but as these were found a kennan too small, the size has been increased an inch each way—that is seven by six. The price put on board is 7*s.* per thousand, and, as wares every way so equable pack as beautifully as herrings in a barrel, we presume, although we do not know the fact, that freightage from Wales will not greatly exceed 1*s.* additional.—*Glasgow Courier.*

RAILWAY CURVES.

ON reconsidering this subject, we think, as our correspondent R. W. T. suggests, that the engineer who has to set out the line of a railway upon the ground should, in general, confine himself to the *curves*, and in every respect to the line laid down upon the plan, in which case no such question as that proposed by "An Assistant Engineer," could occur. But, since a deviation from the plan may in some instances be allowed, as "An Assistant Engineer's" question proves, we shall endeavour to solve R. W. T.'s difficulty; and for this we must first consider what may have been the cause of the failure. Now there are two cases: *either* the curve has been commenced at a wrong point of the tangent, *or* the operation of setting it out has been inaccurately performed. In the first case the error can be rectified by referring to the plan and ascertaining the right point of contact, and then setting out the curve afresh. This method would, no doubt, be exceedingly troublesome, and it appears to be the object of "An Assistant Engineer" to dispense with the labour attending such a proceeding; the question then is, what is the best method of getting over the difficulty without returning to the plan laid down, when a deviation from the latter is allowable. Now when two curves were intended to meet and form an S, and the engineer employed to set them out has not succeeded in effecting their junction, there are two cases: *either* the two curves intersect each other, *or* they do not. In the first of these cases, it is true, the two curves *may* be joined by a third, tangent to the two former, and of less radius than the one which it touches on the concave side, though, in our opinion, it would be preferable to correct the curve in accordance with the plan. Now there are an infinity of circular arcs which will satisfy the condition of being tangent to the two given curves, so that another condition must be imposed before the connecting curve can be determined; it may therefore be required, either that this curve shall touch the concave or the convex curve at a given point, or that its radius should be of a given length, which latter is the condition assumed by "An Assistant Engineer." We should recommend solving the problem on the plan, and not on the ground, believing the former mode to be much more facile than the latter; we shall therefore adapt our solution to that method.

Fig. 1.



Let A B and C D, (fig. 1) be the two given curves (say of 130 chains radius), and let it be required to unite them by a third curve of less radius, tangent to A B on its concave, and to C D on its convex side.

1st case. The required curve is to pass through the point G of the curve A B.

From P, the centre of A B, and through G, the required point of contact, draw the straight line P G H, equal to the sum of the radii of the two given curves, or twice the radius P G (both curves being supposed to have the same radius); from H draw the straight line H O to the centre of the curve C D; and from K, the middle point of H O, draw the perpendicular K Q, intersecting the straight line P H at the point Q. Q will be the centre of the required curve, and its radius will be equal to Q G. Join Q O, and the point E, where Q O intersects the curve C D, will be its point of contact with the required curve.

For, the right angled triangles H K Q, Q K O being equal, Q H=Q O; and, if from these equals we take the equals G H and E O, the remainders Q G, Q E will also be equal; and, since they are situated on normals to the given curves, the circular arc G E will be tangent to both these curves.

2nd case. The required curve must pass through the point E in the curve C D.

From the centre O, and through the given point of contact E, draw the straight line O E Q; and from the centre P draw P L parallel to O Q and equal to the sum of the radii of the given curves; from P as a centre, and with a radius equal to P L, describe an arc of a circle in the direction in which the connecting curve G E is expected to meet the given curve A B, and from L draw the straight line L O H, intersecting that arc at the point H; join H P. The point Q, where H P intersects O Q, will be the centre of the required curve, and the point G, where it intersects the curve A B, will be the point of contact of the required curve with A B.

For, since O Q is parallel to L P, the triangles O H Q, L H P are similar; and consequently, L P being equal to P H, O Q=Q H; and, if from these equals we take the equals E O, G H, the remainders Q G, Q E will also be equal. And an arc of a circle passing through the points G and E, and having Q for its centre, will be tangent to the two given curves, as we proved for the first case. Or after having drawn O Q and L P, construct the isosceles triangle O L M, of which the side O M=M L; then from P as a centre, and with a radius=M L, describe an arc of a circle, intersecting O Q at the point Q, which will be the centre of the required curve, as before.

For, if through the point Q we draw the straight line P H equal to P L, we shall have, by reason of the similar triangles H Q O, H P L, Q H=Q O; and, taking away the equals G H, E O, we have Q G=Q E, as before.

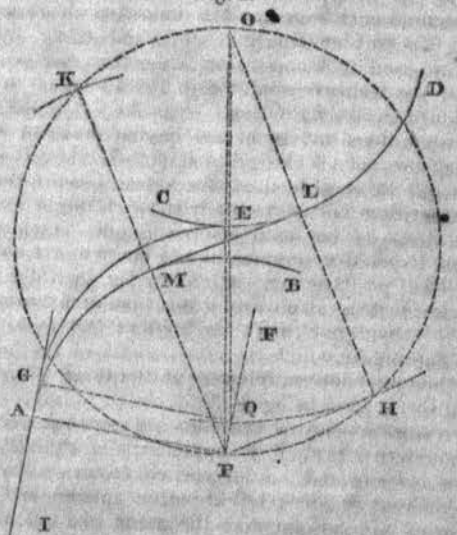
3rd case. The required curve is to have a given radius (say 100 chains).

From the point O as a centre, and with a radius equal to the sum of the radii of the given curve C D and of the required connecting curve, describe an arc of a circle in the direction in which the centre of the latter is expected to be found, and from the centre P, with a radius equal to the difference between the radius of the curve A B and that of the required curve, describe another arc, intersecting the former Q. Q will be the centre of the required curve.

For, drawing the radius P G through the point Q, the part Q G is equal to the radius of the connecting curve, since P Q is the difference between that radius and P G; also Q E is equal to the radius of the required curve, because O Q is equal to that radius, plus the radius of the curve C D, which is equal to the part O E, therefore the remaining part Q E is equal to the radius of the required curve. And it may be proved, as in the former cases, that the arc G E, described with that radius and with the centre Q, will be tangent to both the given curves.

In the case when the two curves intended to have met do not intersect each other, we should certainly recommend connecting them by a tangent, if it should not be required to make them meet, as in the plan.

Fig. 2.



Let A B, C D (fig. 2) be the given curves, the former being tangent to the straight line I A at the point A. To draw a common tangent to the two given curves.

Join (on the plan) their centres O and P by a straight line, and on O P as a diameter, describe the circumference O H P K; than from O and P as centres, and with radii equal to the sum of the radii of the two given curves, describe two arcs of circles intersecting the circumference O H P K in the points H and K respectively; draw the radii O H and P K, and the points L and M, where they intersect the given curves, will be their points of contact with the tangent, that is to say, a straight line L M, drawn through these points, will be tangent to both the given curves.

For O H and P K are parallel, and L H=P M; therefore, joining P H, L M and P H are equal and parallel; but P H is perpendicular to O H, therefore L M is perpendicular to the radius O L, and consequently tangent to the arc C D. In the same manner it may be proved to be tangent to A B. Therefore L M is the common tangent required.

If, on the other hand, it be required to move the curve A B along the tangent I A, from which it springs, until it comes in contact with the curve C D.

From the centre P draw P F parallel to I A, which produce in the direction A G; and from O as a centre, and with a radius equal to the sum of the radii of the given curves, describe an arc of a circle intersecting P F and Q. The point Q will be the centre of the curve which will touch the curve C D and the straight line T G; and, if we draw O Q and Q G, the latter perpendicular to A G, the points E and G, where these two lines cut the curve C D and the straight line A G, respectively, will be the points of contact, and the arc E G will be the required curve.

For Q G and Q E are each equal to the radius P A, and the former is perpendicular to A G, and the latter to the tangent to the curve C D at the point E. Therefore E G is the position of the required curve.

We have thus far only considered the case where the failure has resulted from making one of the curves spring from the wrong point of the tangent. In the other case, that is, when the operation of setting out one or both of the curves has been inaccurately performed, there is no remedy but to set it out again with more care.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XIII.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. Let B. of Derby be whoever he may, his remarks on Competition Designs are very much to the purpose; and he not only hits the right nail on the head, but gives it a clincher, when he hints very broadly that the profession have to thank themselves for the abuses which now prevail with respect to competition. If instead of merely shrugging their shoulders with a most Turk-like resignation, they were to apply them heartily to the wheel, they might extricate themselves from a position they affect to deplore. Surely if the Institute were to set about doing so in downright earnest, they might both devise and enforce a greatly better system of competition than the hollow, shuffling, delusive one now practised. Undoubtedly there are many difficulties to contend with,—first and foremost, their own apathy, indifference and want of unanimity of purpose. Some among them are notoriously opposed to competition altogether, and perhaps that the bungling and blundering now so rife in it, will sooner or later cause it to be abandoned entirely. Others seem to be afraid of making any stir about what does not immediately concern them as individuals. On that very account all the more imperative is it that the Institute as a body ought to consult the interests of the profession generally. And if competition be not a case wherein it ought to interfere with all its authority,—be not more especially one which calls for hearty co-operation, I should very much like to know where co-operation can at any time be of positive service. Were the Institute a private Club, it might be left to do as it pleased: but it is—and it may be presumed, wishes to be considered in a very different light,—to cut a figure in the eyes of the public.

II. Whether any one will agree with me or not, I incline to the opinion that so far from being at all calculated to improve architectural taste, such a work as Nash's Mansions is likely to flatter a very corrupt one, and to create a prejudice in favour of a style that taken apart from the associations and accidents, is characterized by fantastic dullness, by incoherent caprices, by expensive ugliness, and by a grotesque combination of extravagant embellishment and offensive meanness. What then, am I insensible to the charm which the mastery of the artist's pencil has communicated to the series of architectural subjects above-named? Certainly not, because it is precisely on account of the fascination with which he has invested them, that I hold them to be dangerous, and apt to seduce, and mislead those who have not the power of discriminating between the architectural deformity of many of the scenes, and the pictorial attractiveness with which they are represented. Undoubtedly many of them are highly picturesque in themselves, and rendered still more so by the manner in which they are treated, and by the adventitious interest arising from costume and figures. Still as architecture, they are for the most part naught,—absolutely frightful. Were equal witchery of effect put into it, not the homeliest merely, but nearly the most insipid subject of the kind might be rendered captivating,—an old barn, a village carpenter's shop, or the kitchen of a country inn. The chief difference would be that in such case persons would not be similarly imposed upon, but instead of attributing any beauty to the scene itself, or being at all blinded to its uncouthness, would perceive that the pleasure it affords arises entirely from the charms with which the pencil has arrayed it.

III. I should very much like to know if, among the numerous churches which have been erected of late years, there be a single one whose interior possesses, or even approximates in any degree to solemnity of character, which quality, it may be presumed, is perfectly appropriate and becoming, or, in fact, to be considered indispensable, to a place of worship. Among all the new churches I have seen, I have certainly not beheld one possessing internally any thing like solemnity in its general effect; on the contrary, differ how much they may as to all other circumstances, they agree as far as the absence of that quality goes. Some are dismal and mean enough, others, if not particularly tasteful, smart enough, just the very places for a fashionable congregation, whom the architect generally takes care to arrange so that they shall make as goodly a show as the audience of a theatre, and be able to reconnoitre each other without obstruction. In fact, there is, so far, very much more of the play-house than of the house of prayer in such buildings—nothing calculated to inspire feelings of reverence. Neither does it make much difference what style be employed, since the interiors of our modern Gothic churches have no greater air of impressive solemnity than have those in any other style. In only very few instances is there any attempt to keep up the mere corporeal semblance of the style; all its spirit, all its attractions, are gone. Richness seems to be quite out of the question, and soberness almost equally so, for notwithstanding the excessive parsimoniousness which betrays itself, there is also a good deal of vulgar jauntiness and spruceness, bad enough in itself, and thus rendered doubly odious. In some of these buildings a tawdry organ-case is the principal object, all the rest consisting only of base, coldly glaring white walls, pews and galleries, the altar itself being hardly noticeable, except on account of the meanness it displays. In short, it is to be feared that our new churches, taken generally, are not calculated to impress foreigners with any high opinion—I do not say, of our taste, but of our religious ardour, if the latter may be judged of from the externals of public worship.

IV. The Reformers have completely discomfited the Conservatives, if not in politics, most certainly in architecture. The poor Conservative Clubhouse now looks sulkier than ever, now that the rival edifice proudly displays itself in its full majesty. I gladly hail the Reform Clubhouse, as an auspicious omen of reform in architecture; it being likely to disgust with that vapid and poverty-stricken so called classical style, which at the best has given us little more than scraps and bits of Grecian architecture, and that chiefly as regards columns alone, since any thing with a shelf on top of it will, we find, do for an entablature. Good lack, my old friend Classicality, how strangely hast thou been cockneyfied since thou took up thy abode among us! It grieves one to think of it, and yet one cannot help laughing, either, at the grotesque figure thou makest in thy present costume, and what is the worst part of the business is, thou hast been thus fantastically tricked by those who all the while have professed the utmost respect for thee.

V. I was pleasingly surprized the other day by the sight of a very great rarity, namely, an architectural volume both amply and beautifully illustrated with engravings, though only a very few copies of the work was printed for distribution among the author's friends. The work appears to have been got up without the least regard to expence. and so far forms a most complete contrast to the blundering, ostentatious, niggardness manifested in the "privately printed" yet tolerably well known volume of Sir J. Soane's, containing a set of coarse and almost caricature prints, intended to show different parts of his own house. On such occasions there is no excuse whatever for stinginess, or anything like it, because a man had better keep his money in his pocket, than fling it away in purchasing for himself the reputation of being an extravagant hanks and a miserly spendthrift.

But I have not mentioned the name of the liberal-spirited individual who, in the work first alluded to, has so worthily illustrated the interior architecture of his paternal residence at Great Yarmouth—W. F. Palmer, Esq., F.S.A. Such an example ought to be made known as extensively as possible, for if there were a few more of the kind, it would not be amiss. If it be said it argues a mere mania, it is to be hoped that a mania of this kind will prove quite as catching as that which induces people to fling themselves off the Monument, to the extreme horror of those philanthropists who would read of their jumping into the Thames quite unconcernedly. Yet it is rather to be apprehended that architectural mania, amateur-mania, will never prove infectious in this country. The truth is, John Bull is likely to stick fast to his old monomania, which, in plain English, is literally a *money-mania*.

REEFING STEAM-BOAT PADDLES.

Fig. 1.

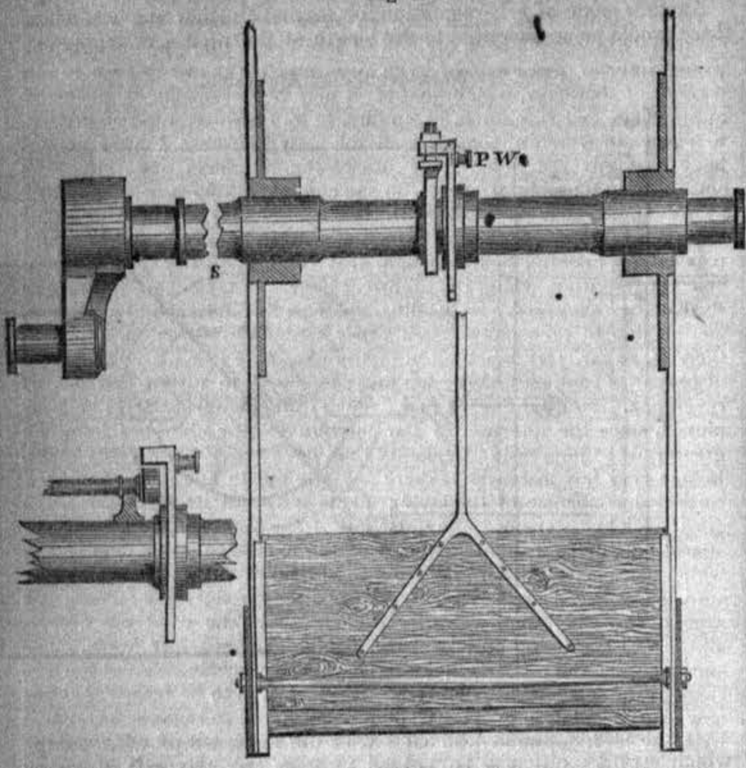
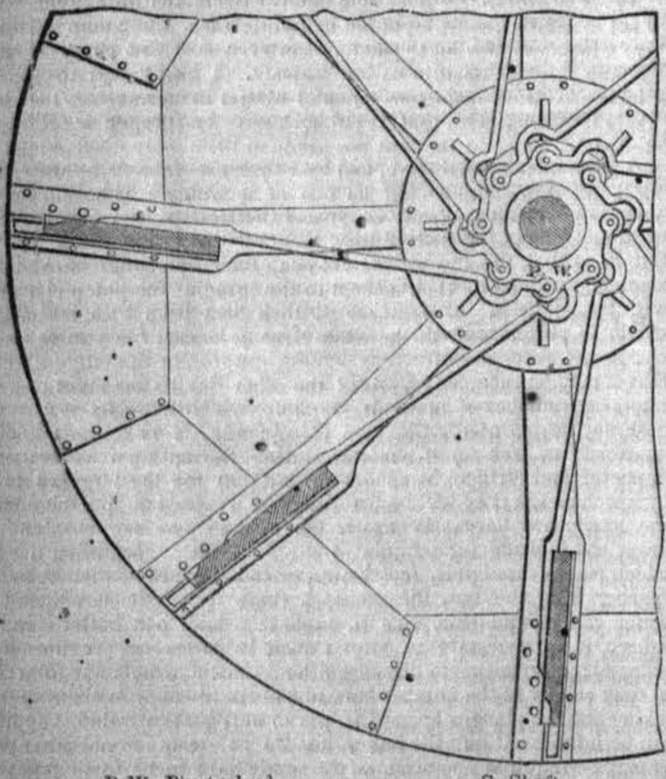


Fig.



P. W, Pivot wheel. S, Shaft.

Sir—Observing by some of the public journals that the reefing of steam-boat paddles is becoming a matter of interest, I take the liberty of sending a rough copy of a simple method executed by Messrs. Boulton, Watt & Co. for a vessel on the Tyne in the year 1815 (whose draught was variable,) it was found to answer well.

The extreme diameter when the boards were out, was 11 ft.; by the mode adopted, they could be drawn in 7½ in., reducing the diameter to 9 ft. 9 in., which was considered sufficient for a vessel of only 5 feet immersion.

By the application of a lever, the whole of the boards were moved at once, and fixed in the required position by a screw pin; this involved going into the paddle-box to make the adjustment previous to starting, but the operation is capable of being performed by a pinion working into the internal circumference of the pivot wheel (shewn in the small side figure), while the quantity of reefing may be carried to all necessary extent by enlarging its diameter.

It was the fashion in those early days of steam navigation to fit the wheels with shrouding, which, although not necessary to the scheme, I have chosen to show it as executed at that period. Should you consider this worthy of insertion, you will oblige, Sir,

Your constant reader,
T. Z.

London, 20th January, 1840.

PATENT IMPROVED BOILER OR APPARATUS FOR GENERATING STEAM.

The first part of my invention consists of an apparatus (after described) for causing water in the state of dew, or divided into very minute drops or particles, to descend slowly through the interior of the boiler or generator, upon the heated surface of which, so much of it as is not converted into steam during its descent, ultimately falls; by which means a less quantity of heat is abstracted during any given time from the heated surface, than if such surface were covered with a continuous sheet or film of water, or with a body of water, as in the common boiler. And by the means I adopt, I do not merely raise steam, by wetting the heated surface, but the boiler or generator when at work is filled by dew or water in a state of minute division, which in its descent, becomes partially converted into steam, by the heat of the atmosphere or vapour within the boiler itself.

I find that a temperature of 500° or thereabouts, of Fahrenheit, in the body or substance of the boiler or generator, is that best adapted to the purpose of raising steam.

Another part of my invention consists of a self-acting apparatus, (afterwards described) for regulating the supply of water to the generator or boiler, according to the condition of the heated surfaces, and the consequent force of the steam within the boiler, that is to say, that if the boiler contains a greater body of steam, or of greater elastic force, than is necessary for the wants of the engine or other purpose to which it may be applied, then by the self-acting apparatus before referred to, the stroke of the force or supply-pump is shortened, so that when the steam is high in the boiler, the quantity of water injected becomes proportionably less; by this means, if by any chance in consequence of the boiler becoming heated to redness, or to any other degree of heat which would be highly dangerous in other boilers, or from any other cause, steam of a violently elastic force be produced, its effect is, through the medium of the above regulating apparatus, to shorten, or totally shut off, the supply of water, until the surface becoming cooler, or producing steam of less elastic force, the pump is again allowed to act; such a case, however, can never happen, excepting after the engine has been standing still for some time, and when, by neglect or design, the usual precautions and attention bestowed upon other boilers have not been observed, as the damper regulator, which is somewhat similar in effect to those in present use, will always prevent the fire being in advance, or more powerful to heat the surfaces, than the water to cool them.

In applying this invention, it will be generally found desirable to keep that part of the surface of the boiler, exposed to the immediate and corrosive action of the fire, covered with water, by which means it will be prevented from burning, and another part of my invention consists in a self-acting apparatus adapted to attain this object. By this apparatus (which is hereinafter described) the water is prevented from accumulating in the boiler beyond the quantity found best in practice, and which, in the boiler I generally use, is from three to six inches in depth over the fire; this apparatus, at the same time that it prevents the water rising in the boiler beyond a certain limit, acts upon the force-pump in a way which will be presently described, so as to reduce the quantity of water injected, if necessary.

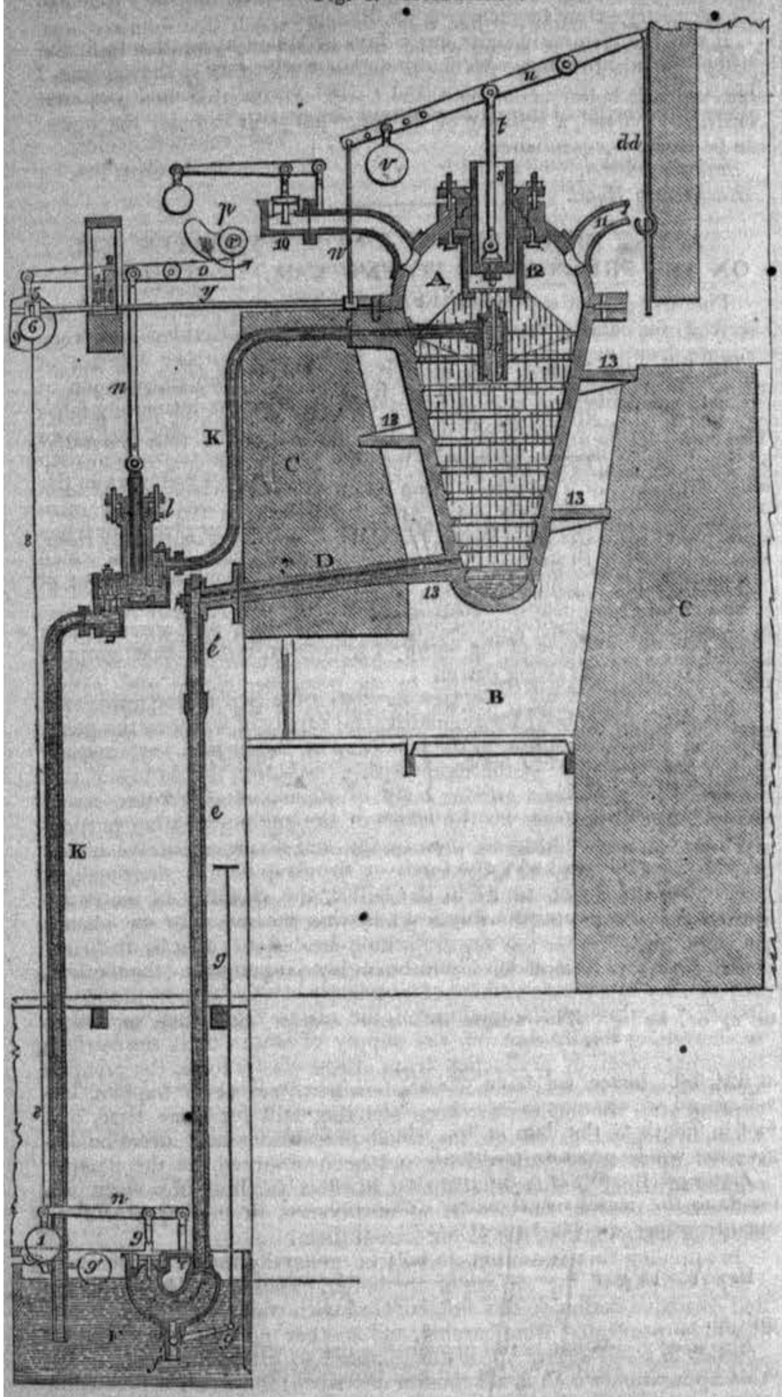
In applying my invention, I employ metal flues, by which means the fire is not only kept longer upon the surface, but the flues become carriers or depositaries of heat, and by radiation impart a certain portion of the effect of the fire upon them to the boiler, and thus economize fuel, besides adding to the strength of the boiler itself.

Another part of my invention consists in forming ridges in the interior of the boiler, by which the descent of the water over the surface is retarded, but which, although a great improvement to the action of the boiler, is not absolutely essential to it.

The external figure or shape which I have generally adopted as the best in practice, will be seen by the accompanying figure; but any convenient form may be employed, and the fire may be either external as shown in the figure, or internal according to the system usually adopted in steam-vessels.

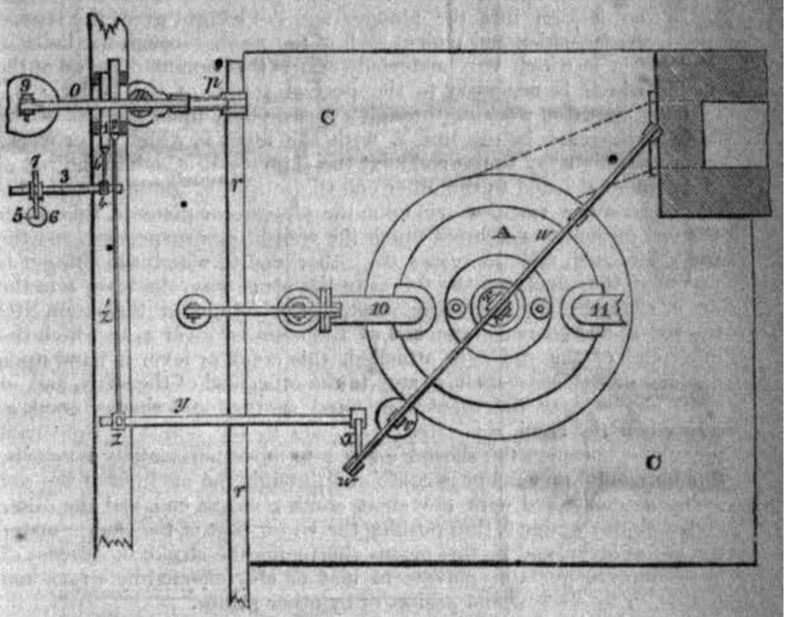
Figure 1 exhibits a cross section of the boiler, pump, and water-valve, with a representation of the water-regulating apparatus. A is a boiler, made of cast iron or other metal, around which is cast the spiral flue 13, and having its interior formed into ridges or corrugated, which ridges increase in width as they approach the bottom of the boiler. B is the fire-place, C the brickwork in which the boiler is set, D the water-pipe, by which the water in the boiler flows off as soon as it has risen to a level with the mouth of the pipe; the water then descends through the pipe *e e*, to the water-valve box *f*, and would pass out into the cistern F if not kept back by the valve *g*; the valve *g* is loaded with weight *i*, and lever *h*, so that it resists the pressure of the steam, in the same way as the safety-valve 10; but when the water accumulates in the descending pipe *e*, so that there shall be an altitude of water above the surface of the valve of from four to six feet, the valve will be unable to sustain the additional pressure of from two to three pounds per square inch upon its area, and it will lift and let out the water, until the descending column balances the weight of the valve; the cock *f* is for the purpose of blowing out any sediment which may have accumulated in the valve box, this is done by depressing the rod *g g*, attached to the lever *g′*, which is fixed on the plug of the cock.

Fig. 1.—Cross section.



Another mode of self-regulation for marine or other engines, when there would be an objection to the length of the pipe *e*, is as follows

Fig. 2.—Water-regulating Apparatus.



a pipe descends, and is connected with the suction-pipe of a pump, which may be either a bucket or force-pump; the exit valve or clack, is loaded by a weight and lever, like a safety-valve, with the same object as the water-valve already described, viz. that it may counteract the pressure of the steam in the boiler. When the pump is full of water, the action of the plunger will force out of the pump as much water as it displaces in its descent, and draw into the pump from the pipe a corresponding quantity of water, thus emptying the pipe, and preventing the water rising above its proper level in the boiler.

A glass tube is employed at *e′*, by which the state of the water may always be observed, and the usual brass mounting is attached, for the purpose of cleaning either the lying or vertical pipes; C is the force or supply-pump, the suction-pipe K′ draws its supply from the cistern F, so that the hot water escaping from the boiler is used over again and no heat lost; *k* is the injection pipe of the pump connected with the nozzle *m*; at about one-third its length from the bottom, the nozzle is perforated with a circle of small holes, drilled so as to discharge the water in a direction slanting upwards, or in such a direction that it may be reflected upwards from the sides of the boiler or generator, (any number of holes in any figure which experience may suggest may be adopted), the best plan I find is to make them about a quarter of an inch apart, and about the hundredth part of an inch in diameter, and drilled in such way that they may be largest outside, by which means they will be less likely to be clogged up; the ends of the nozzle are loose, the upper end screws into its place, and the lower end is made a good joint and ground in, so that when the bolt which passes through it, and the upper end is screwed with a nut and spanner from the top, the nozzle becomes perfectly closed, and no water can escape excepting through the small perforations in the sides; it is necessary to form the ends loose, or provide some other adequate means to discharge the sediment, which may from time to time collect in the nozzle; this adjustment is easily made by merely taking out the plunger *s*, and the perforated plate *s′*, when a spanner can be introduced into the boiler, and the nut or upper end unscrewed as may be required; sometimes the nozzle is formed in a circle with jets like a gas burner, but the above described method I have found to be the best.

The action of the injected water is clearly seen by the dotted and prolonged descendieg lines, the water impinges violently against the sides of the vessel, and is then thrown off at an equal angle in an opposite direction, after which it descends in a vertical shower as shown, it is not necessary that this mode should be always observed, any mode is good that minutely divides the water, and then allows it to descend slowly upon the heated surfaces may be adopted to my invention; but it is essential that the water should be first discharged upwards, either in an inclined direction or perpendicularly, or that it should be discharged in such a direction that it may be reflected upwards, or slanting upwards from the sides of the boiler.

The plunger of the pipe C is connected by the link *n* with the lever *o*, this lever is worked by the cam *p*, fixed on the shaft *r*, which shaft is driven by any of the usual and suitable modes from the engine, or any other equivalent mode of lifting the lever may be adopted; to the end opposite to that on which the cam acts, is suspended the weight *q*, so that the cam lifts the plunger and the weight gives the stroke, producing a sudden and violent rush of the water through the holes of the nozzle *m* which very materially affects that minute division of the water which is necessary to the perfect action of the boiler, *s* is a plunger or piston working through a stuffing box, upon the top of the boiler connected by the link *t*, with the lever *u*, which lever works upon the centre *r*, to the end next the chimney is attached the rod of the damper *d d*, and to the other end the weight *v*, and the rod *w*, thus when the steam rises, it acts upon the plunger or piston *s*, this raises the end of the lever *u*, upon which the weight *v* is suspended, and the rod *w* attached, and depresses the other end to which the damper is attached, thus damping the fire as in the usual way, the lever *u* in the act of rising by the increasing elasticity or volume of the steam lifts the rod *w*, and likewise the end of the crank or lever *x*, to which the other end of the rod *w* is attached, this crank or lever is fixed upon one end of the cross shaft *y*, and to the other end of the shaft, and at right angles with the crank *x* is fixed another and shorter crank *z*, thus when the crank *x* is raised vertically by the action of the steam plunger *s*, it causes the shorter crank *z* to move horizontally forwards, this horizontal movement is continued through the medium of the rod or bar *z′*, connected with the short crank *z* at one end, and the other end with the wedge 2, thus pushing the wider part of the wedge under the pump lever, and by this means shortening the stroke or descent of the pump plunger, this movement may be also effected by a rack and pinion, or by a screw and pinion, or by other means.

I do not claim the plunger or piston as new, to regulate the damper, an analogous contrivance, having already been made; that part of my invention which I have before referred to as a self acting apparatus for preventing an undue accumulation of water in the bottom of the boiler, is as follows; to the extreme end of the lever *h*, of the water-valve, is fixed a slight bar, wire, or chain, 8; the other end of the wire or chain is connected to the short horizontal crank 7, fixed upon the short cross shaft 3; to the longer arm 5 of the horizontal crank, is suspended the weight 6, which weight, when the wire or chain is slackened, descends, and descending, produces motion in the shaft 3, to which the crank is fixed, and also in the short crank 4, fixed upon the other end of the cross shaft 3; thus as the weight descends, the crank 4, by means of the rod 4′, connected with it, and the wedge 1, draws the wedge 1 forward; by the wider part being thus drawn or introduced under the lever *o* of the pump, the stroke of the pump is shortened, and the supply of water consequently diminished. I do not confine myself to the particular modification of machinery here described for effecting this object, but any other adapted to the purpose may be used; thus for instance, another mode of regulating the action of the pump, is by forming the descending tube about 8 or 10 inches internal diameter, and placing therein a float, which shall rise and fall with the water in the tube in the same way as the float in the feed head of a common boiler regulates the damper, then a wire passing through a stuffing box in the upper part of the pipe *e*, and communicating with the crank 7, in the same way as the wire 8, the same movement will take place in the wedge 1, as has been before described; in the case of a locomotive where the pump plunger is connected with the cross head of the piston rod, and works very fast; the method to be adopted to reduce the stroke of the pump, will be to make the barrel of the pump moveable, then by means of a screw fixed to the end, and causing the nut in which the screw works to be acted upon either by the steam plunger or the lever of the water valve, and thus making the barrel of the pump advance towards, or recede from the plunger, the same regulating process will be easily applicable; it will be merely necessary that the suction and injection pipe should work in stuffing boxes, or by making them elastic to allow for the variation; 9 is the pipe and cock for supplying the water cistern with water, *b′* is the ball-cock which keeps the water to its level, 10 is the safety valve, 11 the steam pipe, 12 the steam casing in which the plunger works, the lower part is covered with a plate perforated with holes, so that the steam plunger may work more steadily, and not be acted upon so suddenly by the steam, as the steam before acting upon the plunger will pass through the holes of the plate, and thus a certain regularity of action will be preserved, which could not be ensured without it.

A boiler upon this construction, but made in a very rude manner for the purpose of experiment, 2 ft. deep, 1 ft. over at the bottom, and 2 ft. wide at the widest point, was at work for some time driving a 6 horse condensing engine at Messrs. Burton & Sons, engineers, Bankside, but now of Holland Street, Blackfriars Road; the area exposed to the fire was about 8 ft., and this drove the engine fully loaded, the steam blowing off during the greater part of the time; it had no tendency to get red hot, and upon several occasions, for the mere purpose of the experiment, the engine was stopped, and the boiler purposely made red hot, when the only result that followed was a rapid generation of steam whilst the water was pumped into the boiler; by this apparatus the great desideratum of a powerful, portable, and safe boiler is obtained, and I feel certain that in a properly constructed vessel, a velocity of 20 miles per hour through the water can be easily accomplished.

W. J. CURTIS.

Stamford Street,
Blackfriars Road.

ON THE PRESSURE OF WATER AND THE STRENGTH OF COFFER-DAMS.

By John Neville, C.E.

The following prepositions are intended to furnish rules for calculating the dimensions of coffer dams from having the depth of water, and the specific gravity of the materials to be used in the dam given. The construction of the coffer dam is supposed to be that generally adopted, namely, two or more rows of piles having the spaces between filled with clay, or a mixture of clay and gravel, the whole united into one mass by walings, bolts, &c. And it will be seen that the dimensions found from the investigated formulæ do not differ materially from those adopted with success by many celebrated engineers.

The pressure arising from mere depth of water is not the only force to be prepared against in constructing a coffer dam, as moving water or an exposed situation must also be taken into consideration. These latter I have not calculated for in the following problems, as I consider they are sufficiently provided for by the resistance of the piles penetrating the bottom, which assists the solidity of the dam; and by the auxiliary aid of stays and braces, and have determined the dimensions of the dam itself as only sufficient to resist the pressure of an outside depth of dead water.

Problem I.

To determine the amount of pressure against a coffer dam or obstruction, the depth of water being given.

Put c for the depth of water in feet. The pressure on each point of the dam is as the depth of that point from the surface of the water; the whole pressure for the depth c is therefore represented by the area of a right angled triangle having the base and perpendicular each equal to c, or by $\frac{c^2}{2}$. The weight of a cubic foot of water may be taken at 62½ lbs.; hence we have $62\frac{1}{2}\times\frac{c^2}{2}=\frac{125c^2}{2}$ for the pressure on each foot in length of the dam in lbs., which, multiplied by the length, will give the whole pressure required.

Example 1.—What is the pressure on each foot in length of a coffer-dam, the water inside being exhausted, and the depth of water outside being equal to 15 feet?

Here $c=15$ and $\frac{125c^2}{2}=\frac{125\times15\times15}{2}=14062\frac{1}{2}$ lbs., the pressure required.

Example 2.—What is the pressure against a coffer dam whose girth is 60 feet, the depth of water outside being 20 feet?

Here we have $\frac{125\times20\times20}{2}=25000$ lbs. for the pressure on each foot in length, therefore $25{,}000\times60=1{,}500{,}000$ lbs. is the pressure required.

Problem II.

To find the effective pressure against a coffer dam or lock gate, the depth of water outside being given: a given depth of water being inside.

Put c for the outside depth of water, and d for that inside, we then get $\frac{125c^2}{2}-\frac{125d^2}{2}=\frac{125(c^2-d^2)}{2}=\frac{125\times(c+d)\times(c-d)}{2}$ for the pressure on each foot in length, when the inside and outside girths are equal; putting therefore g for either girth, we get $\frac{125\times(c+d)\times(c-d)\times g}{2}$ for the pressure required.

Example 1.—Given the depth of water on the outside of a dam equal 20 feet, that inside equal 6 feet, and the girth 60 feet, what is the effective pressure against the dam?

We have $c+d=26$, $c-d=14$, and $g=60$ therefore $\frac{125\times(c+d)\times(c-d)\times g}{2}=\frac{125\times26\times14\times60}{2}=125\times26\times14\times30$ $=45,500\times30=1,365,000$ lbs. for the effective pressure.

When the inside and outside girths differ, by putting g for the outside girth, and g' for that inside, we get in this case $\frac{125(c^2g-d^2g')}{2}$ for the effective pressure.

Example 2.—Given the height of water on the sill to the upper gates of a lock above, 10 feet and girth 24 feet; below 4 feet and girth 25 feet—what is the effective pressure on the gates?

The pressure is equal $\frac{125(c^2g-d^2g')}{2}=\frac{125(100\times24-16\times25)}{2}$ $=125(100\times24-8\times25)=125\times1000=125,000$ lbs. the pressure required.

Example 3.—Find the effective pressure against a coffer dam, the exterior depth and girth respectively being 27 and 120 feet; and the interior depth 5 feet, and girth 100 feet.

Here by the formulæ $\frac{125(27\times27\times120-5\times5\times100)}{2}=$ $125(729\times60-25\times50)=125\times424,90=5,311,250$ lbs. the pressure required.

Problem III.

To find the centre of pressure in a given depth of water: or that point where the force of the whole pressure is equal to the sum of the forces arising from the pressures at different depths from the surface.

The whole pressure (problem 1) is represented by a right angled triangle having its base and perpendicular each equal to the depth of water, and as the pressure at each point along the depth is proportional to the depth of such point from the surface, or which is the same thing to a line parallel to the base at that point meeting the hypothenuse; the centre of pressure is evidently on the same horizontal line with the centre of gravity of the triangle. But the latter is at one third of the perpendicular from the base, therefore the centre of pressure is at one-third of the depth of water from the bottom, or $\frac{1}{3}c$.

Examples. The centre of pressure in 15 feet of water is 5 feet above the bottom: in 18 feet of water at 6 feet above the bottom: and in 30 feet of water at 10 feet above the bottom.

Problem IV.

To find the centre of pressure when given depths of water are inside and outside a coffer-dam.

By putting as before c for the depth outside, and d for that inside, we find the outside pressure acting at the distance $\frac{1}{3}c$ from the bottom equal $\frac{125c^2}{2}$ (problems 1 and 3), and the inside pressure acting at the distance $\frac{d}{3}$ equal $\frac{125d^2}{2}$. The centre of pressure is now therefore in the fulcrum of a lever, whose length is $\frac{c-d}{3}$, which lever is acted on at its ends by the two pressures $\frac{125c^2}{2}$ and $\frac{125d^2}{2}$. To find this point we have $\frac{125c^2}{2}+\frac{125d^2}{2} : \frac{c-d}{3} :: \frac{125d^2}{2} : \frac{(c-d)\times d^2}{3(c^2+d^2}$ the distance of the fulcrum from a point corresponding to $\frac{1}{3}c$, therefore $\frac{c}{3}-$ $\frac{(c-d)\times d^2}{3(c^2+d^2)}=\frac{c^3+cd^2-cd^2-d^3}{3(c^2+d^2)}=\frac{c^3+d^3}{3(c^2+d^2)}$. The distance of the point required from the bottom of the water from which we deduce the following rule:—

Divide the sum of the cubes of the inside and outside depths by three times the sum of their squares, the quotient will be the distance of the centre of pressure from the bottom of the water.

Example.—Take $c=20$ and $d=10$ we then have $\frac{20^3+10^3}{3(20^2+10^2)}=\frac{8000+1000}{3\times500}=\frac{9000}{1500}=6$ feet for the distance of the centre of pressure from the bottom.

Problem V.

To find the centre of pressure in a depth of water lying between the depths c and d below the surface.

Let c be the greater depth, and put x for the distance of the centre of pressure in the depth $c-d$, from the centre of pressure in the depth c; we then have from the properties of the lever

$$x\times\frac{125(c^2-d^2)}{2}=\frac{2(c-d)}{3}\times\frac{125d^2}{2},$$

from which equation by an easy reduction we find $x=\frac{2d^2}{3(c+d)}$ therefore $\frac{c}{3}-\frac{2d^2}{3(c+d)}$ is the distance of the point required from the bottom of the depth c, and $\frac{2c}{3}+\frac{2d^2}{3(c+d)}$ its distance from the surface of the water.

Example 1.—In 15 feet depth of water what is the distance of the centre of pressure of the lowest 5 feet from the bottom?

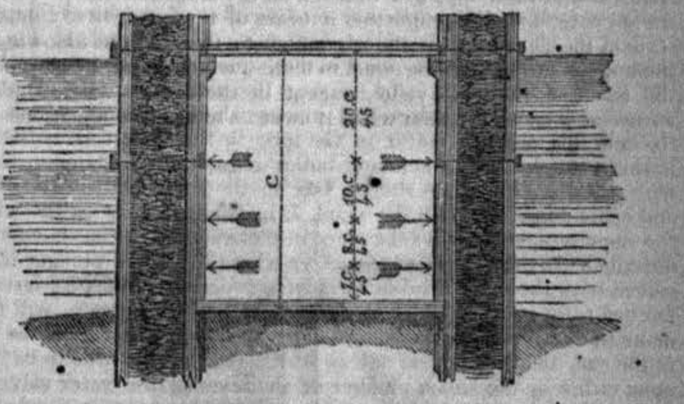
Here $\frac{c}{3}=5$ and $\frac{2d^2}{3(c+d)}=\frac{2\times10^2}{3\times(15+10)}=\frac{200}{75}=\frac{8}{3}$ feet, therefore $\frac{c}{3}-\frac{2d^2}{3(c+d)}=5-\frac{8}{3}=\frac{7}{3}$ feet the distance required.

Example 2.—Two stays support a coffer-dam at depths of 20 and 10 feet below the surface of the water, and it being found necessary to place another between these, at what distance shall we place it from the lower stay, so that it may afford the greatest assistance possible?

It is easy to see that the third stay must be applied opposite the centre of pressure. To find this point we have $c=20$ and $d=10$, therefore $\frac{c}{3}-\frac{2d^2}{3(c+d)}=\frac{20}{3}-\frac{2\times10^2}{3(20+10)}=\frac{20}{3}-\frac{200}{90}=\frac{20}{3}-\frac{20}{9}=\frac{60-20}{9}$ $=\frac{40}{9}=\frac{44}{9}$ feet, the distance required.

A proper knowledge of the position of the centre of pressure will enable us to place our stays with advantage and economy, particularly in those cases where a coffer-dam is surrounded with water. If the top and bottom of such a coffer-dam (fig. 1) are kept from approaching each other, the next best point to secure is evidently at the centre of pressure of the whole depth of water, or using the same notation as before at $\frac{1}{3}c$ from the bottom. If more stays are necessary, the most important points to be secured are those at the distance $\frac{7c}{45}$ and $\frac{5c}{9}$ from the bottom, or in other words at the points corresponding to the centres of pressure in the lower and upper portions of the depth $\frac{c}{3}$ and $\frac{2c}{3}$.

Fig. 1.



Problem VI.

To find the dimensions of a coffer-dam fig. 2 sufficient to resist the pressure of a given depth of water when the section is rectangular.